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ELECTRONICS AND ELECTRICAL ENGINEERING

No. 91

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UDC 621.391.2

IMPROVEMENT OF CHARACTERISTICS OF RADAR SYSTEM WITH USE OF CYCLICAL CODES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 8, Aug 81 (manuscript received 9 Apr 80) pp 85-87

LAZUTKIN, A. B.

[Abstract] In the majority of practical and significant cases, the electromagnetic field of valid signals, interference and thermal noise, operating in the antenna apertures of radar systems are approximated by a Gaussian random process. In this case synthesis of optimum systems for detecting valid signals and evaluation of the coordinates of their sources reduces to a synthesis of filters, optimum with respect to the criterion of the probability ratio. With the use of complicated signals, optimum filters are transversal. Synthesis of complex filters can be realized with the aid of cyclical codes. A method of improving the characteristics of a radar system with the use of such codes is proposed. Figures 1; references: 3 Russian.
[91-6415]

UDC 621.396.6

HIGH-SPEED CHARACTERISTICS OF STANDARD SECTION OF NONCOHERENT SYSTEM FOR SELECTION OF MOVING TARGETS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81 (manuscript received after completion 23 Feb 81) pp 44-46

KISELEV, A. Z. and KURYNIN, V. B.

[Abstract] This brief communication considers the standard section of a noncoherent radar station which includes a filter, the characteristics of which are matched with the principle of modulation of a sounding signal, a linear detector, a device for single interperiod subtraction, a square-law generator and an integrator. The object of the communication is derivation

of the velocity characteristics of a system--dependence of the quality of discovery (selection) of a target from the speed of its movement. It is shown that in noncoherent systems of selection of moving targets, integration of signals after the device for single-stage interperiod subtraction (ordinarily accomplished on the screen of an indicator), can lead (with highly correlated interference) and a sufficient number of periods of integration) to a relative weakening of targets moving with "optimum" speed ($X_\Delta = 0.5$) in comparison with targets moving with a speed close to "optimum". Figures 2; references: 3 Russian.
[90-A-6415]

UDC 621.396.96

DEPENDENCE OF ACCURACY OF MEASURED POLARIZATION CHARACTERISTICS OF TARGET ON PARAMETERS OF RADAR MEASURING INSTRUMENTS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 11, Nov 81
(manuscript received 2 Jul 80) pp 50-52

KAZAKOV, Ye. L. and RYZHOV, D. N.

[Abstract] In radar instruments for measuring the polarizational scattering matrix of targets it is not technically feasible to ensure a perfect decoupling of orthogonal channels. A decoupling of 30 dB is attainable with special devices only, and with a decoupling less than that additional measurement errors appear. Here decoupling is defined as the ratio of quadrature component to principal component of a radar signal received after reflection by a sphere. The relative mean and rms errors in determining the moduli of principal and quadrature elements of the polarizational scattering matrix are calculated as functions of the ellipticity of the radar measurement base. The results indicate the limit of ellipticity permissible in the design of radar instruments on the one hand and the necessity of compensating the effect of ellipticity on the other. According to data based on a real radar system with only an elliptically nonorthogonal measurement basis, a decoupling higher than 20 dB is required, or trimming of the receiver channels to compensate the effect of a decoupling less than that. A typical trimming device consists of a commutating delay line, a synchronizer, controlled attenuators, controlled phase shifters, an adder, and amplitude detector, a phase detector, and a comparator. Figures 3; references 2: 1 Russian, 1 Western.
[155-2415]

UDC 621.396.967:629.735.33

DETERMINATION OF LENGTH OF SEA WAVES WITH RADAR FROM AIRPLANE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 15 Apr 80) pp 2447-2450

GARNAKER'YAN, A. A., KARAKUSH'YAN, V. L. and BUKHARIN, V. D.

[Abstract] In order to determine the parameters of sea waves with a short-wave radar from an airplane, it is necessary to establish the relation between the time spectrum of the reflected signal during flight in a given direction and the space spectrum of a surface section in the same direction. It is then possible to turn from space to time frequencies of signal fluctuations. The feasibility of thus measuring the length of sea waves was tested on the Black Sea in 1976 and 1978 with a special pulse radar operating at the 10 m wavelength. Airplane flights with the radar on board were conducted at altitudes from 400 to 4000 m at velocities from 200 to 500 km/h in various directions relative to the main directions of sea waves propagation. The envelope of the reflected signal at the radar receiver was recorded with a loop oscillograph. The average period of waves $\bar{T}$ was determined from the rise of the water surface and the average length of waves was determined from the relation $\bar{\lambda}_{b.min} = g\bar{T}^2/2\pi$ (g- gravitational acceleration). The error did not exceed 10-15% for waves longer than 10 m, this error being almost independent of the airplane altitude as well as of its bank and pitch angles. Figures 1; references 6: Russian.
[94-2415]

SATELLITE TV BROADCASTING

Moscow RADIO in Russian No 11, Nov 81 pp 5-8

BYKOV, V. , DUDKIN, V. and ZAYTSEV, D.

[Abstract] A brief history of satellite TV broadcasting in the Soviet Union is presented, including a review of the economic factors which make satellite broadcasting economically desirable in a nation as geographically huge as the Soviet Union. Each of the three systems in use ("Orbita", "Ekran", and "Moskva") is briefly described, including first satellite launch dates, orbital parameters, frequency spectrum allocation and prospects for future use. The USSR has been arbitrarily divided into 5 broadcast zones, each with a 2-hour time zone difference. In the future, the "Ekran" and "Moskva" systems will largely take over the task of network TV broadcasting with the appropriate time delays for the geographic zones. The "Orbita" system will be used along with surface broadcast links to distribute secondary programs. It is noted that the problem of distribution of TV programs originating other than in Moscow is not yet completely solved. Figures 5; tables 2; references: 7 Russian.
[171-6508]

UDC 523.164:621.391.278

REFINED EXPRESSION FOR COMPENSATION RADIOMETER SENSITIVITY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 15 Apr 80) pp 2469-2471

MURZA, L. P.

[Abstract] An expression for the sensitivity of a compensation radiometer, in terms of minimum signal power detectable in a signal and noise mixture, is derived which also takes into account the prescribed accuracy of the signal power estimate and a generally attendant other than normal distribution of the signal voltage over the finite measurement time. The derivation is based on estimation of the complex random voltage at the output of the high-frequency amplifier from a truncated sample within a finite time interval. The sensitivity according to this expression represents the limiting radiometric power gain as the number of voltage readings asymptotically approaches infinity. A precise evaluation according to this expression reveals that the conventional expression yields an overestimate. When the minimum detectable signal power must ensure a prescribed probability of correct detection, upon application of the Neyman-Pearson criterion and comparison with a threshold based on a prescribed false-alarm probability, the expression for the limiting power gain or sensitivity is somewhat different. The author thanks E. G. Mirzabekyan for helpful discussion of the work. References 8: 6 Russian, 2 Western (one in translation).
[94-2415]

UDC 534.231.1:537.622.6

REFLECTION OF SURFACE MAGNETOSTATIC WAVES BY PERIODICALLY UNEVEN SEGMENT OF FERRITE SURFACE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 28 Oct 80) pp 2282-2290

GULYAYEV, Yu. V., NIKITOV, S. A. and PLESSKIY, V. P.

[Abstract] Reflection of surface magnetostatic waves by a periodic Bragg grating spread over a segment of a ferrite (typically iron-yttrium garnet)

surface is analyzed, taking into account that such waves independently propagate in opposite directions. The dispersion equation is derived from the equations of magnetostatics, with both the magnetostatic potential and the normal component of magnetic induction remaining continuous at both boundaries of the ferrite plate. The solution to this equation in the form of a Bloch function is found by the "two associated waves" method. Resonance, corresponding to opaqueness over the entire grating, occurs when the wavelength of surface waves is twice as large as the period of the uneven structure profile. Reflection coefficients are calculated on this basis for the smooth surface segment and then for surface segments with common forms of periodic unevenness, namely a sinusoidal and one occurring in a Fabry-Perot resonator. Also transmission coefficients are calculated, inasmuch as the region of opaqueness diminishes as either the wavelength of surface waves decreases or the period of the uneven surface profile increases away from resonance. Attenuation due to absorption is disregarded here. The authors thank P. Ye. Zil'berman and A. V. Vashkovskiy for helpful discussions. Figures 5; table 1; references 11: 1 Russian, 10 Western (2 in translation).
[94-2415]

UDC 537.874.3

REFRACTION IN ATMOSPHERE ACCORDING TO OBSERVATIONS FROM 'SALYUT-6' ORBITAL STATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 16 Feb 81) pp 2430-2432

GRECHKO, G. M., GUREVICH, A. S., LYAKHOV, V. A., SAVCHENKO, S. A. and SOKOLOVSKIY, S. V.

[Abstract] Some results of the "Salyut-6" mission are reported, namely data collected by the third crew pertaining to refraction in the atmosphere. Deviation of the refraction angle from that calculated for a standard atmosphere was determined from photographs of the sun. Altitudinal profiles of this deviation were plotted alongside that of the refraction angle in a standard atmosphere. The results indicate that thin atmospheric layers have finite horizontal dimensions. They also indicate the feasibility of direct recording of refraction of optical waves in the atmosphere, the effect of diffraction being insignificant even in the presence of thin layers. At high zenith angles, however, random inhomogeneities must be taken into account in order to ensure an accuracy not worse than 10%. The authors thank A. M. Obukhov for his steady interest. Figures 2; references 6: 4 Russian, 2 Western.
[94-2415]

UDC 538.56:519.25

LARGE EJECTIONS OF ONE-DIMENSIONAL MARKOV PROCESSES

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 7 Jul 80) pp 1252-1255

VIROVLYANSKIY. A. L. and MALAKHOV, A. N., Gor'kiy State University

[Abstract] The paper is concerned with an investigation of ceratin statistical characteristics of ejections of the one-dimensional Markov process $X(t)$ given the stochastic equation $\dot{X} + a(x) = \xi(t)$ [1] where $a(x)$ is a continuous function, where $a(\pm\infty)\pm\infty$ and $\xi(t)$ is Gaussian white noise with a zero average. Similar equations rather often occur in problems of statistical radio physics. (An equation of more general form $\dot{X} + b(x) = c(x)\,\xi(t)$ reduces to [1] by a simple substitution of variables.) Also considered are ejections of the process $(x)t$ greater than the level $x = h \gg x_0$. In a 1961 work from the literature an evaluation is obtained of the average frequency of appearance of a series of ejections. In the present paper it is shown how it is possible to obtain a substantially more detailed description of the statistics of a series of ejections of the process $x(t)$ beyond the level $h \gg x_0$. The statistics of other ejections outside the fixed level of a one-dimensional stationary Markov process are also considered. The authors thank A. I. Saichev for helpful discussions. References: 2 Russian.
[132-6415]

UDC 550.388.2

D-REGION PHYSICS AND FORECASTING OF RADIO WAVE PROPAGATION (REVIEW)

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 12 Dec 80, after completion
20 May 81) pp 1171-1199

DANILOV, A. D., Institute of Applied Geophysics

[Abstract] This work is concerned with a survey of problems connected with D-region physics from the view point of the possibility of physical forecasting of the state of this region and the corresponding aspects of the propagation of radio waves. The authors is deeply convinced that in the lower ionosphere only physical modelling will be able in time to assure solution of numerous problems connected with prognosis of propagation, taking into consideration the complex connection of the D region with the meteorological characteristics and the diversity under way in its disorder. And even though as yet these two aspects (physics and propagation) have failed to consolidate sufficiently closely, only their joint consideration can approach to a solution of the problem of prognosis of the D region.

At the time of the International Seminar on Heliogeophysical Prognosis, which took place in April 1979 at Boulder, Colorado, particular attention was paid to the work of the special working groups on the importance of "typing up" the problems of the physics of the D region and its importance in the propagation of radio waves. The terms "C-region" or "C-layer" is sometimes used in the literature for designation of the region of the ionosphere below 60-65 km. Because the question of the reality of the existence of increased concentrations of electrons at these heights is definitely not solved, in the present work (as this occurs in the majority of publications) the term "D-region" is extended to all the ionosphere from 50 to 90 km. The following major items are considered: 1) Effect of D region on propagation of radio waves; 2) Physicochemistry of D region; 3) Possibility and prospects of prognosis. The author is deeply appreciative to Ye. A. Benediktov, A. A. Nikitin and A. V. Shirochkov who read the manuscript of the work and offered a number of very useful comments. Figures 6; tables 2; references 146: 20 Russian, 126 Western.
[132-6415]

UDC 621.317.743.7

CONSTRUCTING COMPACT POLYGONS FOR ANTENNA CHARACTERISTICS MEASUREMENTS BY COLLIMATOR METHOD

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 14 Oct 80) pp 29-35

KAPLUN, I. V. and KOLOSOV, Yu. A.

[Abstract] In recent times use is more and more widely made of compact polygons intended for measurements of the characteristics of the directivity of antennas by the collimator method, during which the field irradiating the antenna is formed by an auxiliary antenna—collimator arranged close by the unit being tested. The present work quantitatively evaluates the errors of measurement and considers a method for design of compact polygons. The principal design relations, the effect of defects in the manufacture of a collimator and the effect of reflections from the wall of an anechoic chamber are considered. Figures 3; references 6: 5 Russian, 1 Western in translation.
[90-A-6415]

UDC 621.371.24

COHERENT PROPERTIES AND FOCUSING OF WAVE BEAMS REFLECTED IN TURBULENT MEDIUM

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 12 Dec 80) pp 1234-1239

KRUPNIK, A. B. and SAICHEV, A. I., Scientific-Research Radiophysics Institute

[Abstract] A 1973 work from the literature is cited which describes the effect of an increase of the average intensity of waves reflected in a turbulent medium. In the present work the function of coherence of inflated waves is investigated. It is shown that when blow-up of the beam because the medium is in excess of its diffraction widening, a small but wide pedestal makes its appearance in the coherence function, which gives rise to an increase of the average intensity in the center of the focal plane of the lens. The coherence function is found for a wave reflected from an infinite random-heterogeneous shield. A possibility is found for measuring the radius of coherence of a wave falling on the shield with respect to the width of distribution of the average intensity of the reflected wave in the focal plane of the lens. Figures 2; references 7: 5 Russian, 2 Western.
[132-6415]

UDC 621.372.8:537.874.37

ACOUSTIC METHOD OF MEASURING MEAN AIR TEMPERATURE IN CHANNEL OF BEAMGUIDE LINE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 30 May 80) pp 2432-2435

VETROV, V. I. and DUBROV, M. N.

[Abstract] Use of beamguides for transmission of electromagnetic waves with high phase stability in geophysical measurements requires a highly accurate determination of the mean air temperature along the beam trajectory. An acoustic method of measuring this temperature is proposed which utilizes the strong temperature dependence of the acoustic velocity in air. This dependence can be described by the relation

$$c = 20.56\sqrt{T}(1 + 0.14\frac{e}{p}) + v_t$$

with c- phase velocity of sound (m/s), T- absolute temperature (K), $\frac{e}{p}$ - ratio of vapor pressure e (mbar) to total pressure p (mbar), v_t- longitudinal component of wind velocity. From this relation is derived an expression

for the phase shift along the channel, namely

$$\Delta\phi = \frac{-\ Lf}{20.05T}3/2\ \Delta T$$

with L- distance from radiator to receiver (m) and f- frequency of sound (Hz). The measuring equipment consists of an oscillator, a receiver amplifier, a phase meter, and a recording instrument. It was tested in 1.5-6 h runs during the 22-28 December 1977 period, with L = 100 m and f = 1000 Hz. The variation of the phase shift recorded with this equipment was checked against the variation of the mean air temperature, $t = 1/2(t_1 + t_2)$, measured with two thermometers at depths of 1.7 and 2.2 m respectively. The accuracy of this method, found to be within 0.01°C, can be improved by the use of more accurate phase meters and by correcting for humidity and pressure variations inside the beamguide. Figures 3; references 5: 4 Russian, 1 Western.
[94-2415]

UDC 621.372.8:551.510.52

EXCITATION OF ELEVATED TROPOSPHERIC WAVEGUIDE BY ELECTROMAGNETIC FIELD OF GROUND BASED SOURCE AND SCATTERED BY MEANS OF SOUND WAVE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 13 Oct 80) pp 1227-1233

KUKUSHKIN, A. V., Institute of Radio Physics, UkSSR Academy of Sciences

[Abstract] Channeling of a field in an elevated tropospheric waveguide formed by an inverse index of refraction is one of the possible mechanisms for long-distance propagation of ultra-short radio waves. The characteristic values of the thickness of the inverse layer and the depth of inversion in it are ordinarily sufficient so that radiation of the centimeter band proves to be "captured" in the waveguide. However the effectiveness of excitation of weakly attenuated modes is determined by the arrangement of the source with regard to the boundaries of the waveguide channel. Capture of the radiated energy in the waveguide channel is caused by diffraction mechanisms or scattered by means of irregular formations in the troposphere. The effectiveness of excitation of a waveguide can sharply increase if scattering of the decreasing field E_0 results at the artificially created nonuniformities. The present work estimates the possibilities of scattering by means of a sound wave. It is shown that if the sound pressure under the inverse layer amounts to a fraction of a millibar, then the level of the attenuation function of the field amounts to approximately -20 db. The work takes into account losses of sound radiation because of the turbulent viscosity of the atmosphere. The author thanks P. V. Bliokh for statement of the problem and together with him I. M. Fuks and V. D. Freylikher for helpful discussions. Figures 2; references: 12 Russian.
[132-6415]

UDC 621.396.43:621.371.392.1:510.52

STATUS AND COURSE OF DEVELOPMENT OF TROPOSPHERIC SYSTEMS OF LONG LINE AND ZONE COMMUNICATIONS

Moscow ELEKTROSVYAZ' in Russian No 11, No 81
(manuscript received 18 Nov 80) pp 5-8

NEMIROVSKIY, A. S.

[Abstract] The stages of development in the USSR of tropospheric radio relay systems (TRRS) and the contemporary status and prospects for development of such equipment are discussed in detail. During the short period from 1953 to 1967, the networks of stationary TRRS exceeded 100 thousand kilometers. At the same time a large number of mobile TRRS were developed and installed. The 1953-1967 years can be called the stage of rapid development of TRRS. Fundamental investigations were made, both in the field of long-range tropospheric propagation of radio waves and in the theory of the transmission of various forms of information via TRRS. In these years journals published more than 1000 times on TRRS. The following stage (1967-1977) is characterized by a further development of TRRS techniques. However, for long line communication routes use of tropospheric lines was more and more restricted. The process began of substitution of TRRS for long lines and the use of them only as inserts in long-line networks in case of the necessity of passage across water obstructions, in remote regions of the world, as well as for branches from long lines--for zone and local networks. The third stage of development of TRRS began about 1977. The developed and installed equipment of the third generation which has a still more perfect elementary base (with a partial use of micromodules and large integrated circuits) and new principles of control of fading during transmission of both analog and discrete information. The contemporary state of tropospheric long lines is characterized by the relatively stable expanse on the order of 100 thousand kilometers. Yearly all over the world there enters several thousands kilometers of such lines (e.g., the direct line USSR-India and others). At the same tropospheric communication lines are converted into radio relay line equipment for direct visability or satellite communication. The present day state of long-line equipment and the prospects for its development are discussed and illustrated. References: 11 Russian.
[142-6415]

USSR-INDIA TROPOSPHERIC COMMUNICATIONS LINE

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 82 inside front cover

[Abstract] On 2 November 1981 a direct international tropospheric communications line with a capacity of 12 telephone channels was opened between the capital cities of the USSR and India. The line is equipped with DTR-12 tropospheric communications equipment consisting of a transmitting

system, two transceiving antennas, a receiver system with a highly sensitive low-noise amplifier and an antifading system. Photographs are presented of the antenna (front cover) and equipment room (inside front cover). [173-6508]

UDC 621.396.96:621.391.126

CORRELATION FUNCTION OF BROAD-BAND SIGNAL RECEIVED BY STRAIGHTWAY ANTENNA ARRAY

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 30 Oct 80) pp 69-72

MAKSAKOV, N. F., SOKURENKO, V. L. and KHRUPALO, A. A.

[Abstract] At present, problems of the broad-bandness of antennas with a feeder supply are sufficiently fully illuminated. The prospects and tendencies of the development of antennas with optical excitation of straightway (prokhodnyy) antenna arrays (SAR) require an investigation of the limitations which are superimposed by them on the width of the spectrum of the oscillations in use. In the present brief communication such an investigation is conducted as applied to a linear SAR with an equidistant arrangement of reradiating modules. It is asuumed that in the scanning zone of a radar station, at the receiving point of which a SAR is installed with a beam pattern oriented normal to the aperture, a source of broad-band oscillations is found, coherent in space and noncoherent in time. These oscillations are picked up by the antenna array and experience joint processing with the expected (nondistorted) signal. The processing algorithm includes the operation of computing of mutual correlations, selection of envelope and normalization. During this it is assumed that the units and elements of the antenna, as well as the internal circuits, are broad-band and make it possible to process the signal in the specified frequency bands. An expression (6) for the correlation function is derived which makes it possible to identify the special features of space-time processing of broad-band signals with use of a uniform-amplitude SAR with optical excitation. This function is presented in the form of a surface which characterizes a simultaneous solution with respect to the distance and angular coordinates. An example of the relief of such a surface in the coordinates "angle-time" calculated for $M = 21$ and $b = 0$ is presented. Inasmuch as the spherical abberation in this case is absent, then SAR is an adequate broadside antenna array. As applied to this case, expression (6) breaks down to the composition of two factors, one of which describes the envelope of the output effect of the correlator, the other, the beam pattern of the antennas with respect to voltage. The property of factorization $\rho(x,y)$ significantly lightens attainment of the specified precision and resolving capabilities with respect to angle and distance. The normalized amplitude-frequency characteristics of a SAR calculated for a uniform amplitude distribution are presented. Continuous curves correspond to $L/\lambda_0 = 100$, the dashed curves to $L/\lambda_0 = 200$. It is shown that between the SAR parameters

and the common resolving capabilities of the system with respect to the distance ΔD and the direction $\Delta\theta$, determinable by the product $\Delta D\Delta\theta$, an interdependence exists. In fact, the solution with respect to distance is characterized by a wide spectrum of a received signal which is a function of the bandwidth of the SAR. At the same time the angular solution depends on the dimensions of the antenna and the carrier frequency, consequently improving the simultaneous solution with respect to angle and distance equal to $\Delta D\Delta\theta = 0.125\ \lambda_0 d$ in radians, is attained by a decrease of the length of the wave of oscillations and elimination of the primary element from the reradiation. Figures 6; references: 4 Russian.
[90-A-6415]

UDC 621.396.677:49.01

DESIGN OF OPTIMUM SYMMETRICALLY EXCITED EQUIDISTANT LINEAR ANTENNA ARRAYS WITH ISOTROPIC RADIATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 15 Sep 80) pp 2246-2253

MINKOVICH, B. M.

[Abstract] A method of design optimization, according to the mean-square criterion, is proposed for symmetrically excitable equidistant linear antenna arrays with isotropic radiators which to some extent have arbitrary symmetric radiation patterns. The method is based on the theory of polynomials in the Chebyshev sense, but with the use of Fourier series in sets of orthogonal polynomials with symmetric nonnegative weights rather than in sets of minimum-deviation polynomials for minimization of the energy functional. The procedure is demonstrated on optimization of such an antenna array with respect to minimum weighted power in side lobes or with respect to minimum weighted mean-square deviation from the prescribed side lobes structure. Figures 5; references 12: 9 Russian, 3 Western.
[94-2415]

UDC 621.396.677.75

EXCITATION OF DIELECTRIC CONE OF FINITE LENGTH

Moscow RADIOTEKHNIKA in Russian Vol 36, No 11, Nov 81
(manuscript received 17 Feb 81) pp 44-49

VASIL'YEV, Ye. N., SEDEL'NI VA, Z. V. and SEREGINA, A. R.

[Abstract] Excitation of onical dielectric antenna is analyzed on the basis of an approximate model, namely one without a cylindrical shield near the exciter. The distributions of equivalent electric and magnetic surface currents have been calculated by numerical solution of the

corresponding system of integral equations, after expansion of currents and field intensities into Fourier series in the azimuthal coordinate and with the rotational symmetry of the body taken into account. These distributions represent those of the tangential electromagnetic field components. They have been calculated for a zero taper (cylinder) and taper angles α = 2, 4, 6°, with the dielectric permittivity ϵ = 2.5, 4 and with the excitation source (vibrator) inside at a distance kd = 1.5 (k- wave number, d- diameter) from the larger base on the axis. The normal component of the real part of the Poynting vector, zero at a cylindrical surface, is found to increase with increasing taper angle. This indicates that energy flows from the dielectric into free space around the entire lateral surface of the cone. The radiation patterns, also calculated on this basis, reveal a widening of the major lobe and a narrowing of the side lobes as the taper angle increases. With a higher dielectric permittivity (ϵ = 4) such an antenna becomes superoptimum, in the Hansen-Budyard sense, already without a taper. Figures 5; tables 1; references: 5 Russian.
[155-2415]

UDC 621.396.677

NOISE IMMUNITY OF LATTICE-TYPE SUPPORT WITH PERISCOPIC ANTENNA (NONREFERRED VERSION)

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 81
(manuscript received 28 Jan 81) pp 44-47

GUSEV, V. V.

[Abstract] The present work is concerned with an analysis of the spurious radiation typical with standard designs of antenna construction and measures are proposed for a decrease of its level. During analysis the impossibility is obvious of taking into account all the sources of spurious radiation found in the procedure for construction of new, and modernization of old radio relay lines. However, the physical phenomenon considered in a periscope antenna and the principles of analysis of the predominant spurious radiation remain valid for all practical cases. Measurements were conducted on a model of an antenna construction decreased to a tenth of the normal size. Recommendations with respect to a decrease of spurious radiation are presented. Basic recommendations with respect to the use of periscopic antenna systems are also given. Figures 8; references 2: 1 Russian, 1 Western.
[142-6415]

UDC 621.396.677.49

ANTENNA ARRAYS: EXPERIENCE IN CLASSIFICATION

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 16 Mar 81) pp 25-29

VOL'PERT, A. R.

[Abstract] The present work proposes a classification of antenna arrays, at the basis of which three groups of characteristics are placed: geometrical, electrical and functional. A detailed schematic shows the members of the three groups. Characteristic of each group is their successive arrangement in the scheme. The makeup of each of the groups is discussed. Further development (and refinement) of groups in the limits of the corresponding group can be attained by means of a parallel partition of the classification. The classifications shown are useful for preparation of plans for monographs concerned with antenna arrays and during development of educational or training programs, and are especially necessary during construction of a terminological vocabulary. Figures 1; references 28: 22 Russian, 6 Western.
[90-A-6415]

UDC 662.997.537.22

DETERMINATION OF AXISYMMETRIC DEFORMATION TEMPERATURE OF LARGE PARABOLIC MIRRORS

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian No 6, Nov-Dec 81 (manuscript received 20 Mar 80) pp 47-54

MACHUYEV, Yu. I., SOLODOVNIKOVA, L. A., SOKOLOV, Ye. V., NAZAROV, A. N. and FOKIN, V. G., "Solntse" Scientific Production Association, TuSSR Academy of Sciences

[Abstract] Mildly sloping envelopes of various types are widely used at present. This includes dome-shaped designs of structural building, concentration of solar energy, and the parabolic and hyperboloid bowls for the antennas of radiotelescopes. As a rule all these constructions are found in the open air and are subjected to a complex of climatic influences, among them solar radiation. Heating of the envelope leads to their temperature deformation, to a variation of the surface from the initial state. Such a variation of the surface, unimportant for structural building, must be taken into account in the operation of solar power plants and radiotelescopes. It is shown that in order to assure minimum distortions of the average surface of paraboloid mirrors in the case of temperature distortions, the parameter of the slope of the envelope χ must exceed the magnitude 0.05-0.06. Accordingly it is necessary to select the form of a paraboloid mirror surface. Figures 2; tables 2, references: 3 Russian.
[90-6415]

BROADCASTING, CONSUMER ELECTRONICS

UDC 621.314.2

INVESTIGATION OF TRANSISTORIZED SWITCH-TYPE SECONDARY POWER SUPPLY WITH IMPROVED POWER AND MASS-SIZE INDICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 8, Aug 81 (manuscript received 22 May 80) pp 38-44

ARTYM, A. D., VOGMAN, V. D., KOZIN, Ye. V., MAYOROV, G. S. and MARTYSHEV, Yu. I.

[Abstract] The results are presented of an experimental investigation of a test specimen of a switch-type secondary power supply operating from a three-phase network of 3 x 380 V, 50 Hz, which has an output voltage equal to 27 V and a maximum load current of 30 A. The source was developed for supply of a wide-band transistorized amplifier and a single-sideband transmitter, but it can also be used for many other radio devices. The object of the investigation was determination of the efficiency and measurement of the quality index of the source (instability and pulsations of output voltage) in normal climatic conditions when operating at an effective load resistance and when operating at a real load in a region of modulation of a two-tone experimental signal with frequency modulation $f_{mod} = 300 \div 6800$ Hz and in a carrier regime. Figures 4; tables 3; references 7: 5 Russian, 2 Western (in translation).
[91-6415]

UDC: 621.315.212

ELECTRICAL CHARACTERISTICS OF KM-4 AND KM-8/6 CABLES AT UP TO 60 MHz

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 82
(manuscript received 25 Jul 79) pp 39-42

VORONTSOV, A. S.

[Abstract] The characteristics of coaxial cable pairs were measured using Siemens equipment in combination with IP-10/25 measurement panels produced in the USSR. With the Siemens equipment, the value of α was

measured by comparison and critical frequencies for determination of Z_B and [illegible] were estimated using a compensation circuit. Direct measurements plus the results of plant statistical processing of terminal values for domestic cables measured by a pulsed instrument with a 120 ns probing pulse and a loading circuit reproducing $Z_B = 75$ at 1 MHz were used. Figures 3; references: 6 Russian.
[173-6508]

UDC: 681.327

LOGIC UNITS OF MULTICHANNEL INSTALLATIONS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 2 Apr 80) pp 63-67

BOREYKO, V. F., VALUYEV, Yu. M., GREBENYUK, V M. and ZINOV, V. G., Joint Institute for Nuclear Research, Dubna

[Abstract] A description is presented of a system of logic units (the series 500). These units allow interconnection by twisted pairs, thus reducing the cost of the units and simultaneously increasing their functional capabilities without speed reduction. Converters, shapers, delay units and matching units are included. Schematic diagrams are presented. Figures 6; references 2: 1 Russian, 1 Western.
[172-6508]

UDC 621,377.623.24.621.397.331.222

USE OF TELEVISION DEVICES TO INVESTIGATE SURFACE OF OBJECTS BY MOIRÉ METHOD

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81 (manuscript received 13 Feb 81) pp 39-41

SAMOYLOV, F. V. and TSVETKOV, A. I.

[Abstract] Determination of the form, deformation or defects of the surface of an object by the Moiré bands method is more and more widely used in various forms of science and technology. However, the traditional methods of obtaining Moiré patterns are connected with large complexities of a technological and technical nature and require much time for preparation of the object and fixation of the materials obtained and their processing. It is possible by the use of television devices with fulfillment of a number of technological operations listed in the present brief communication to increase the effectiveness of investigation of the surface of an object. A block diagram of a system for such investigations by the Moiré method is presented and explained. It is concluded that use of television devices

during development of systems for investigation of the surface of an object by the Moiré method makes it possible with the aid of television elements to project work and to form a standard raster, to combine rasters and to fix the Moiré pattern with the aid of a television camera fulfilled on the base of a vidicon with a controlled storage, to succeed in reaching the time of continuous observation of the television image up to 30 minutes with an exposure of 0.02 second. Introduction into a television system of a camera for a memory based on a litokon type storage tube makes it possible to fulfill a preliminary transform of the television signal for matching the latter with the inputs of electronic computer devices. Figures 3; references 6: 5 Russian, 1 Western.
[90-A-6415]

UDC 691.397.62

NOISE IMMUNITY OF TV RECEIVER WITH LINEAR AND SYNCHRONOUS DETECTION

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 82
(manuscript received 13 Apr 81) pp 50-53

GEL'FAND, V. M.

[Abstract] A study is made of the specifics of the energy spectrum of fluctuation noise at the output of a TV receiver. The spectrum of this noise is essentially nonuniform. The use of a synchronous detector yields a gain in noise tolerance over a linear detector of 2.9 dB. The same type of detector should be used in estimating fluctuation noise in the image channel of TV transmitters and relay units. Figures 3; tables 1; references 7: 6 Russian, 1 Western.
[173-6508]

CIRCUITS & SYSTEMS

IC TESTING DEVICES AND SYSTEMS

Moscow AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 12, Dec 81 pp 25-28

[Article by A.M. Pochepa, senior engineer, Odessa Electrotechnical Institute of Communications]

[Text] Integrated microcircuits have recently come into extensive use. This is because they are more compact, reliable, economical and less expensive than the old hardware base.

The number of integrated circuits being used in different instruments, devices and systems is huge, and continues to increase. Therefore, even if we assume that only one out of every thousand integrated circuits malfunctions, it is still necessary to take care that workers master the methods and means for testing integrated circuits.

In order to assist electronic operators, technicians and engineers who wish to supplement their knowledge in this area, the editors of the journal are presenting a review of devices and systems which have been developed by instrument builders, workers in the electronic and radio industries and radio amateurs for testing integrated circuits during production and operation.

Before they reach the consumer, integrated circuits undergo careful testing at the manufacturing plant. The purpose of this check is to disclose any malfunctioning or potentially unreliable articles. If the microcircuits which are shipped to consumers are only spot-checked they can, of course, include defective articles. Microcircuits also sometimes malfunction while operating. The most frequent causes for IC failures are the following: violation of the rules for transporting and storing articles; incorrect selection of electrical modes of circuit operations; intolerable electrical, thermal and mechanical effects on ICs during installation, as well as lax observation of rules and methods for measuring electrical parameters of integrated circuits.

Of all of the types of malfunctions of microelectronic articles, the most frequently encountered are those such as shorting of the input, output and power supply to ground, short circuiting between the input and output, errors in connecting components and instability of parameters.

Integrated circuits are divided into digital and analog, depending upon the type of signals being converted and processed. There are more digital ICs; therefore, most of the attention in the present review is devoted to them.

Until relatively recently, digital devices had been tested with the help of volt-ammeters and oscillographs. Special instruments are now used primarily for these purposes (logical probes, PC-board testers, IC analyzers, various test benches controlled by small and miniature computers, as well as other instruments and systems).

As concerns testing analog circuits, this is usually done using an oscillograph or other traditional measurement instruments, or with the help of special-purpose, fairly complex test setups which use microcomputers; some models even use pattern recognition techniques. Testing a circuit using such a setup consists of inputting signals, entering the data obtained into a computer and comparing that data with the nominal values stored in the machine.

Modern IC testers can be divided into two basic groups: instruments for integrity testing of microcircuits during routine servicing and testing small groups of articles, and instruments, or more precisely test systems, for determining the technical characteristics of articles under series production conditions. The first group includes various logical probes, testers and other simple, compact, inexpensive test devices; the second group includes complicated, very expensive general-purpose test systems and automatic systems which are distinguished by their multifunctionality and short measurement time.

An intermediate position between simple test instruments and complex testing systems is occupied by testing and measuring equipment of medium complexity and cost. This equipment includes pulse generators, simple logic analyzers, testers, comparators and oscillographs which have been specially updated for digital circuit testing. These test instruments are used primarily to test digital devices during design and development.

One of the instruments in this group is the L2-41 integrated logic circuit tester shown in Figure 1. The device uses the functional diagram shown in Figure 2. The tester checks the integrated logic circuit by measuring the voltages at the outputs of the articles being tested with assigned switchable voltage levels at their inputs.

An idea of the complexity and cost of testing systems is provided by some characteristic numbers which are cited in the descriptions of the equipment. For example, the foreign 1790 system includes a digital computer which can make as many as 4000 functional or diagnostic tests per second and can check large ICs with 240 outputs. This system uses an automatic programming device.

An example of an inexpensive (costing about $45,000) test system is the LTS instrument. This is a bench-top programmable functional logical instrument whose function is to test automatically digital printed circuits at high speed and localize defects down to the component level. This device includes a bipolar processor which switches pins at a rate of up to 2 MHz, a CRT display, dual floppy discs, 96 kilobyte RAM, a 16-digit LED, interfaces and a number of other devices.

This system, which is microprocessor-controlled, can be used to check both digital and analog devices. It can work with digital voltmeters, check circuit integrity, measure capacitance, inductance and resistance (including insulation resistance), test the direct voltage drop and leakage current of diodes, evaluate the performance of transistors, stabilizer diodes and linear and digital integrated circuits. The results of testing the circuits are both printed out and stored on discs for subsequent analysis.

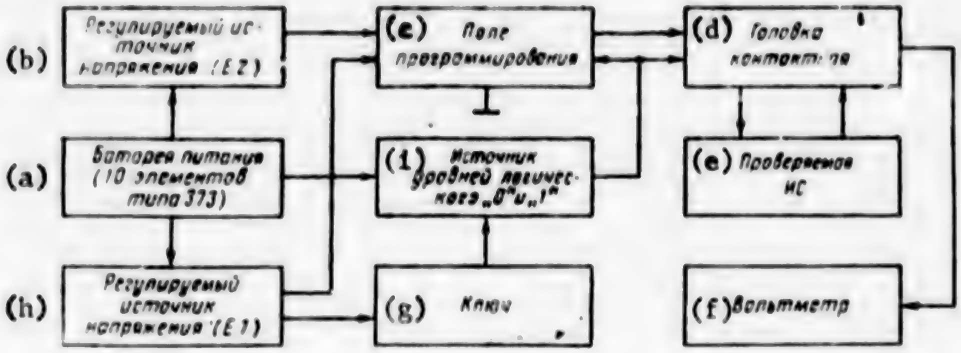
(b) Регулируемый источник напряжения (E2)
(c) Поле программирования
(d) Головка контактирования
(a) Батарея питания (10 элементов типа 373)
(i) Источник уровней логического „0" и „1"
(e) Проверяемая ИС
(h) Регулируемый источник напряжения (E1)
(g) Ключ
(f) Вольтметр

Figure 2

Key:

a. power supply battery (10 type 373 elements)
b. adjustable voltage source (E2)
c. programming field
d. contact head
e. tested IC
f. voltmeter
g. switch
h. adjustable voltage source (E1)
i. logic "0" and "1" level source

Automatic testing devices also include such general-purpose setups as the SLATE system used to test the condition and find malfunctions in complex analog and digital equipment. These installations are usually computer controlled. As many as 35 systems can be connected to the computer, which makes it possible to reduce the expenditures in testing PC boards. The capability is provided of taking signals from 1350 points on a tested board, including internal points. The programs needed for testing can be written automatically according to pre-prepared test tables.

Relatively simple fully programmable automatic equipment, such as the Multitest 24 from Czechoslovakia, are being used increasingly to test integrated circuits. This device contains a digital-analog converter, digital voltmeter, line printer and paper tape punch.

There are several methods for testing integrated microcircuits. For example, one widely used method is that in which the output signals of the tested device are compared with the readings of an analogous device which is used as the standard. The signals are compared using a high speed comparator (for example, operating at 4 MHz), the test takes little time.

Another method is used in complex computer-based test systems. A special test signal which is applied to each input of the tested device is compared with a standard signal stored in computer memory.

A widely used method for testing logic circuits is statistical testing, which consists of inputting statistical signals to the tested circuit and observing the statistical responses at the outputs.

One simple, reliable method for testing logic circuits is that which consists of inputting a defined sequence of binary numbers to the tested circuit, summing them at the output of the circuit being tested and comparing the result with the actual sum of the "input" numbers which is stored in memory. When the "input" and "output" sums agree, the tested circuit passes, otherwise it fails.

In order to increase the reliability of microelectronic articles and reduce the amount and cost of work involved in preparing them, boards are tested both in the final stage of production and during manufacture as well. These intermediate tests are used primarily to determine whether all of the elements have been installed and connected correctly, whether there are any breaks or short circuits, whether the values of the components have been selected properly and whether all of the elements have been installed on the board.

All of these tests are made with the help of widely varying testing and measuring instruments, from a simple probe to a programmable test system. The choice of the test instrument or system is determined primarily by the number of boards to be checked, as well as economic considerations.

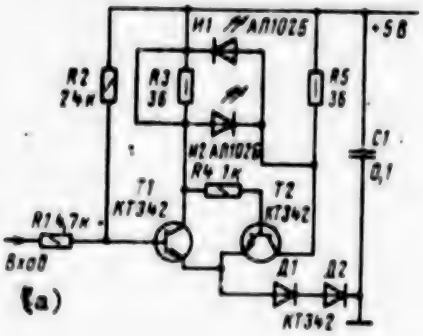

Figure 3.

Key: a. input

The engineer or technician who is learning about special purpose equipment for IC testing for the first time must consider the following.

Analog and discrete circuits are built either on the basis of ordinary analog elements, i.e., resistors, capacitors, semiconductor devices, etc., or on the basis of various integrated elements. In the first case, volt-ammeters, oscillographs and other ordinary instruments are used to test malfunctioning circuits. The task of the test is to find the malfunctioning circuit element.

In the case of analog or digital circuits based on integrated elements, the individual components of the circuit become inaccessible for inspection and measurement, and normal functioning of the device is determined by testing it as a whole. Under these conditions, the inputs of the device are perturbed, and a check is made to see whether signals are present at various outputs, and whether they correspond to one another and to calculated values.

A second thing is what must be kept in mind in looking for malfunctions in logic circuits. Malfunctions of integrated elements may be caused by actual defects, as well as various problems in external circuits to which the circuits being tested are connected.

A simple device for testing logic circuits while operating is the logical probe, which indicates the state (or more precisely the voltage level) at the point in the circuit of the device to which the sharp probe is applied. The indicators in simple logical probes consist of one or several different colored miniature lamps, light emitting diodes and seven-segment light-emitting diode indicators.

Figure 3 shows the schematic diagram of a simple logical probe. This probe can be used to determine the voltage level at the outputs of logic elements, to check whether positive and negative rectangular pulses are being passed, and to find breaks in electrical circuits.

In addition to portability, which is an important property of almost any instrument, an operational tester must be simple, convenient, and must have a minimum number of controls on the front panel. It is also desirable that the circuit and construction of the tester provide the following: power supply from a local source as well as with voltage from the circuit being tested; testing of microcircuits while operating and in the off condition, and connection of circuits in different housings to the tester.

The main task of the operational tester is to detect, rapidly and without error, a malfunctioning microcircuit without unsoldering it from other parts and circuits.

The basic requirements for complex test instruments include high speed, simplicity and convenience in testing integrity of circuits, capability of using simple tests, capability to reproduce test results without error and lowest possible cost.

Year, issue and page of journal RADIO	Name and function of instrument	Primary circuit elements	Remarks
1975, No. 11 p. 61	Logic device condition indicator. Designed to determine logical zero, one and intermediate states	Low-power n-p-n and p-n-p transistors with V of at least 100 AL102 light emitting diodes MLT-0.125 resistors	Main indicator is d.c. balanced bridge
1976, No. 9 p. 46-48	Logic tester. Designed to test devices using series K133 and K155 microcircuits	MLT-0.25 resistors KT312B transistors K155 integrated microcircuits KD503B diodes NSM 6.3 incandescent lamps	
1977, No 1 p. 61	Logic device test probe. Designed to test equipment using TTL microcircuit	KT315B transistors AL304G 7-segment indicator Low-power silicon diodes MLT-0.125 resistors	Probe powered by device being tested
1977, No. 2 p. 60	Simple logical probe. Designed to determine voltage levels at outputs of logic elements, test transmission of pulses and detect breaks in electrical circuits	KT342 transistors Low-power silicon diodes AL102B and AL102V light emitting diodes Resistors	
1977, No. 5 p. 28, 29	Transistorized logical probe. Designed to determine state of outputs of logic devices with microcircuits	KT315D transistors KT361G transistors AL102B and AL102V light emitting diodes MLT-0.125 resistors	Article presents circuit of probe with 7-segment solid state display
1977, No. 5 p. 29,30	Logical probe using operational amplifier. Designed for determining states of outputs of logic devices with microcircuits	K1UT401A operational amplifier MGT108B transistor Semiconductor stabilizer diodes MLT-0.125 resistors NSM 6.3 indicator lamp	Powered from device being tested

Year, issue and page of journal RADIO	Name and function of instrument	Primary circuit elements	Remarks
1977, No. 5 p. 30	Logical probe with logical microcircuit. Designed to test states of outputs of logic devices with microcircuits	K1LB554 logical microcircuit KT312B and DT312V transistors AL102B and AL102V light emitting diodes MLT-0.125 resistors KD103A and GD507A diodes	Circuit of same probe shown with 7-segment display
1977, No. 11 p. 28,29	Logic device tester. Designed to find malfunctions in logic devices using integrated microcircuits, to determine polarity of pulse signals and detect "stretched" edges and "ringing" in signal being tested	KT315B transistors D311A, D311 and D220 diodes K1LB336, K1LB333, K1TK331, K1LI091, K1LB557 and K1LB554 microcircuits MLT-0.25 resistors Indicator lamps	Tester consists of high-power pulse shapers (pulse probes) and logic probe
1978, No. 4 p. 58	Audible logic probe. Used to distinguish four states of TTL microcircuit outputs	KT306, KT315 and KT326 transistors D219A diodes K1LV553, K1LV554 and K155TL1 microcircuits Resistors	A particular low frequency signal corresponds to each of the four states of the microcircuit outputs
1980, No. 3 p. 30	Logic probe for indicating voltage pulses between 0.4 and 2.4 V	KT373B and KT361G transistors K1LB553 or other analogous TTL microcircuits KD512A, AD3A, GD507A silicon germanium diodes MLT-0.125 resistors	Probe mounted on 7.5x80 mm PC board

Year, issue and page of journal RADIO	Name and function of instrument	Primary circuit elements	Remarks
1980, No. 3 p. 30-31	Logic probe. Designed for static and dynamic testing of logic devices	KT315A and GT310A transistors K133LA8 or K155LA8 microcircuit KD103A diodes 7-segment light-emitting diode indicator MLT-0.125 resistors	Powered from device being tested
1980, No. 3 p. 31	Logic probe. Designed to determine voltage levels at outputs of logic devices	KT342V transistors KD103A diodes AL102A light-emitting diodes MLT-0.125 resistors	Powered from tested device; low consumption
1980, No. 3 p. 31-32	Logic probe. Designed to register pulses and determine voltage level	KP305D field-effect transistor KT361A and KT315A transistors KD103A diodes K155LA3 and K155LA8 microcircuits AL304G 7-segment indicator MLT-0.125 resistors	200 KΩ input impedance. Assembled on 1.5x12.5x x127.5 mm two-sided PC board

Relatively simple devices are often used in addition to programmable test systems in integrity testing and finding malfunctions in complex digital devices. The purpose of these simple instruments is to make a preliminary check of the boards to make sure that there are no such malfunctions as short circuits, soldering defects, open circuits, incorrectly connected components and other simple problems. This two-stage testing increases the operating efficiency of test systems and reduces the time required to diagnose the device being tested.

Ordinary logic testers are not suitable for evaluating the performance of complicated digital devices such as microprocessors. The integrity and technical characteristics of such devices can only be determined with the help of a complex programmed test system. The programs which are used provide for such tests as measuring the power supply current, integrity-testing the circuits from external leads, testing the output logical zero and one levels, checking the leakage currents at the inputs and outputs and functional testing. The latter provides a great deal of useful information, especially when it is done at different temperatures, for different extreme combinations of supply voltages and timing frequencies, before the tested device is put into operation and at the end of testing during the guaranteed service life.

In conclusion, a few words regarding specific models of simple instruments and new microcircuit test facilities. A description of these can be found in the Soviet popular scientific literature, and in patents in class G 01 R 19/00. Some brief information is presented in the table regarding the devices which are simplest and most accessible for manufacture.

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6900
CSO: 1860/141

UDC 538.563:534.83

ANALOG-DIGITAL ADAPTIVE DELAY LINE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 11 Jul 80) pp 1256-1266

MAL'TSEV, A. A. and PATRONIS, Ye. T., Gor'kiy State University

[Abstract] The paper is concerned with a theoretical and experimental investigation of an adaptive filter of a special type - an adaptive delay line (ADL). The ADL makes it possible in the simplest way to solve the problem of identification of a medium (system) with an unknown delay time and amplification (reduction) of compensation of an echo signal with an unknown attenuation, time lag and some other things. The principles of construction and operation of the ADL are described. The time lag and amplification of the ADL are described. The time lag and amplification of the ADL are controlled by an adaptive algorithm based on the gradient method of steepest descent. In the work an investigation was made of the characteristics of the ADL only in steady-state operating conditions, i.e., after completion of the processes of adjustment (adaptation). A series of experiments was conducted with the use of the ADL, both for identification of an unknown system (unknown delay time T_0) and for separation of a signal from a mixture of signal and noise (autocompensation of echo interference). The principal results of the experiments and their comparison with theory are presented. The analytical expressions developed are verified by the experiments with the ADL. The investigations conducted in the work make it possible to be confident that the ADL can find use for an adaptive filter of a special type where there is a priori information concerning the properties of nuisance interference or the properties of an unknown system which it is necessary to identify. At the same time it should be noted that for effective use of ADL in practical problems it is necessary to conduct a farther, more complete investigation of the characteristics with nonstationary effects, consideration of the process of dynamic adaptations, as well as the study of the influence of fluctuations of the fine-adjusted parameters T (delay time) and W (weight coefficient) on the operation of the system. The authors express their deep appreciation to Professors J. Ford and J. Stevenson of the Georgia (USA) Technological Institute for their aid and constant attention to the work. Figures 9; references 7: 5 Russian, 2 Western.
[132-6415]

UDC: 621.314.2

STABILIZED POWER SUPPLY FOR INTEGRATED MICROCIRCUITS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 20 Aug 79) pp 134-137

MAKHOTENKO, A. B. and KABANOV, Yu. M.

[Abstract] A schematic diagram and description are presented of a power supply designed to power integrated microcircuits from a standard 220 V AC line. The theory of operation of the device is briefly described. The device uses a converter which operates in the 20-100 KHz band, thus serving as a source of high-frequency interference. Therefore, the input and output filters and the converter elements are carefully shielded. The method of double shielding is used in the converter. Figures 1; tables 1; references: 4 Russian.
[172-6508]

UDC 621.317.755.3

INTEGRATED CIRCUITS OF INPUT DEVICE OF STROBOSCOPIC TRANSDUCER BASED ON GALLIUM ARSENIDE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 8, Aug 81 (manuscript received 29 May 80, after revision 29 Sep 80) pp 10-17

STAROSEL'SKIY, V. I. and SUETINOV, V. I.

[Abstract] The present work gives an account of the basic principles of planning integrated circuits based on gallium arsenide for stroboscopic transducers (ST). The following points are considered: 1) Special features of integrated fulfillment of ST input devices; 2) Principal circuit of ST input device; 3) Transfer characteristics of mixer; 4) Noise properties of mixer; 5) Optimum planning of mixer; 6) Practical realization of integrated circuit of ST input device; and 7) Evaluation of limiting parameters of integrated circuits for ST. Six figures are used in the overall discussion. It is concluded that the investigations conducted showed that the integrated fulfillment of the input device of the ST makes it possible to improve its basic parameters to a considerable extent. It is advisable to fulfill the integrated circuit of the input device on the basis of gallium arsenide and to incorporate in it a mixer using Schottky diodes, a preliminary cascade of an amplifier of expanded pulses in the form of a source follower based on a field-effect transistor with a Schottky gate and a pulse former using a Gunn diode. V. I. Starosel'skiy (see above) is involved in 5 of the 10 references. Figures 6; references 10: 9 Russian, 1 Western.
[91-6415]

UDC 621.372

ANALYSIS OF NONLINEAR EFFECTS IN CIRCUITS HAVING PERIODICALLY CHANGING PARAMETERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript received 21 Apr 80, after revision 28 Nov 80) pp 44-49

ANISIMOV, Ye. N., ASTASHKEVICH, B. A. and RYABOVA, E. N.

[Abstract] Two works in the literature are cited which consider nonlinear distortions in the capacitance of frequency converters. However, both these procedures are inaccurate, because not all the methods of forming spectral components are considered. If the characteristics of the nonlinear element are represented by an exponential series, it is possible in calculations to use a method based on a Volterra series. This method makes it possible to consider all possible means for formation of an unknown component in the spectrum of output voltage. However, it is possible to employ it only in the case where all the output signals are weak. The nonlinear properties were analyzed under the conditions stated above. Although the assumption concerning the smallness of the pumping signal is very crude, it makes it possible to show a number of qualitative regularities, in particular the possibility of compensation of the nonlinear components by means of a choice of load in a circuit using an inoperative frequency. The present work gives a generalized procedure for the case of a strong pumping signal when the circuit can be described as a system with periodically changing parameters. The apparatus of the functional Volterra is practically not used. The procedure in questions assumes a lower level of signal and an arbitrary level of pumping. With strong signals in reality on several frequencies the problem must be solved as a problem of finding a steady-state regime. Figures 3; references 4: 2 Russian, 2 Western.
[91-6415]

UDC 621.372.018.78

TRANSIENT PROCESSES IN FILTERS DURING EFFECT OF SIGNALS WITH PERIODIC SUDDEN CHANGE OF PHASE

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 18 Feb 81) pp 57-60

VLASOV, M. M. and BAYGOLA, I. A.

[Abstract] In the case of the correlation method of processing linear-frequency-modulated signals (LFM) in radars and measuring devices with the help of filters, signals are analyzed in a form similar to harmonic signals with a periodic sudden change of phase. Transient processes in filters

which are caused by a sudden change of phase are accompanied by the appearance on the radar display of side lobes on the basis of range, which mask the target signals. In a frequency modulated (FM) reflectometer (measurement of structure and characteristics of complex microwave channels with the help of wide-band FM signals) the transient processes appear not only in noncorrespondence of the measured structure of the microwave channel to the actual location of nonuniformities, but also in error of measurement of the frequency characteristics of the nonuniformities. The present brief communication analyzes the transient processes at the output of a filter in the case of an input signal with periodic sudden change of phase, and certain methods for their suppression are investigated. The results of calculation of the maximum values of the transient processes for the case where $\Omega_s/\Omega_t = 2.5$ (Ω_o = frequency of harmonic oscillations) are shown in a figure by dashed lines. For comparison, continuous lines show the maximum values of transient processes at the output of the initial section of a 2nd order filter with approximation of the characteristics of Battervort functions and $\Omega_s/\Omega_t = 5.0$. A sufficiently important suppression of the transient process takes place with $2.0 \leq \frac{\Omega_o}{\Omega_t} \leq 3.0$. Figures 2; references: 4 Russian.
[90-A-6415]

UDC 621.372.54.01

SYNTHESIS OF ACTIVE FILTERS BASED ON IDENTICAL SECTIONS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 8 Oct 80) pp 20-24

GREBENKO, Yu. A. and SAVKOV, N. N.

[Abstract] Active [illegible]-filters based on identical sections are promising for microelectronics use, suitable for rearrangement of parameters and simple in adjustment. However, the procedures for their design are insufficiently developed. The present work proposes a more general algorithm for synthesis of the structures of filters of any type and of arbitrary order, based on algebraic transformations of the transfer function of the synthesized filter, bringing it to a form convenient for the construction of a structural scheme in the form of a signal graph. During development of the algorithm it was kept in mind that in planning of filters of high order for assignment of the form of the amplitude-frequency characteristic and the phase-frequency characteristics it is convenient to utilize normalized low-frequency prototypes. Use of frequency converters permits synthesis of any type of filter and reduces to synthesis of a low-frequency prototype. The proposed algorithm of synthesis assures preliminary solution of two problems: 1) Determination of a low-frequency prototype of a synthesized filter; and 2) Choice of the type and parameters of the initial identical sections. It is shown that an analysis of the synthesized structural circuit of a band-pass filter, as well as having practical experience

in creation of a number of filters of various types which correspond to prototypes of the second to fifth orders, verifies the reliability of the proposed algorithm of synthesis. The results of the experimental investigation of the amplitude-frequency characteristics of these filters with the use of elements with small spread of the parameters (less than 1%) differ from the theoretical by not more than 0.4 dB. Figures 4; references 4: 2 Russian, 2 Western.
[90-A-6415]

UDC 621.372.54:621.391.888

PULSE MODELS OF SYSTEMS WITH N-CHANNEL FILTERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 13 Aug 79, after revision 2 Jul 80) pp 2453-2456

ZEZYUL'KIN, G. G.

[Abstract] An exact method is proposed for analysis of transient and steady processes in closed systems with N-channel filters. The method is based on pulse models and avoids the use of difference equations. The structure of such a system is schematically represented by N parallel channels containing each a time-invariant filter with the same transfer function H(p) between an input modulator and an output modulator. The method is demonstrated on the most common type of modulation, namely modulation by periodic jump functions f(t) and p(t) with N constant levels and N jumps at equal intervals per period. These functions are transformed to linear combinations, i.e., series of complex exponential functions forming complete orthogonal sets. The schematic structural diagram transforms correspondingly to one without modulators but with pulse elements instead. Transient and steady processes are now analyzed with the aid of conventional or modified Z-transformation. Figures 3; references 5: 4 Russian, 1 Western (in translation).
[94-2415]

UDC 621.372.543.2

DESIGN OF DIGITAL BAND-PASS FILTERS OF TCHEBYCHEFF TYPE

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 16 Jan 81) pp 79-81

YAVORSKIY, B. I. and DOMBROVSKIY, Z. I.

[Abstract] Realization of digital filters is possible, both by the program method and in the form of specialized computing devices. At present

the elementary base of logical microcircuits makes it possible to construct specialized computing devices for analysis of signals in acoustics, biology, and seismology in real time. Procedures for calculation of the coefficients of a transfer function of a filter are cited in a number of works in the literature. Realization of a filter is accomplished with sections of not more than the second order. However, it is desirable to have single-type sections when a simpler device of control, the mean-statistical length of a word in the register of the sections are the same. The single-type of the sections is determined by the symmetry of the characteristics of their structure with reference to the factors which determine the conditions of their functioning. From this point of view, a section is interesting, the transfer function of which has two zeros with the coordinates $z = \pm 1$ and two conjugate poles. The present short communication proposes a procedure for calculation of the coefficients of a transfer function of such sections for realization in cascade form of a digital band-pass filter of the Tchebycheff type. The method of calculating the filter is described. Band-pass filters with a cascade connection of second order sections were calculated and realized by the proposed procedure. The second order section is a specialized computing device with a fixed point in which multiplication and addition of numbers are fulfilled, represented by a binary parallel code. The overall make up of the computing device is described. Figures 1; references 5: 4 Russian, 1 Western. [90-A-6415]

UDC 621.373.53

MULTIPHASE PULSE GENERATORS BASED ON INTEGRATED MICROCIRCUITS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript received 12 May 80, after revision 3 Oct 80) pp 18-24

PADALKO, O. A. and YAKOVLEV, V. N.

[Abstract] Devices for forming several sequences of pulses shifted in phase relative to one another are widely used as digital phase shifters, and generators of clock pulses for devices with charge-coupled and computational units based on dynamic elements, time-delay generators, etc. It is possible to obtain the indicated pulse sequences with the aid of self-oscillating multiphase generators based on triggers. Variations are described of the construction of generators on the basis of typical integrated microcircuits and problems are considered of their synchronization and of quartz stabilization. The following figures are shown and explained: 1) Block diagram of n-phase pulse generators; 2) Principal circuit of a two-phase pulse generator on the basis of integrated logic elements, "AND-NOT" transistor-transistor logic included in the circuit of a RS-trigger with inverse inputs, with a time-master RC-network with charge of a capacitor; 3) The operation is considered of a two-phase generator with forming of two sequences of pulses, one of which is detained with respect to the pulses of the other at a specific and regulated time. The principal

circuit of such a generator on the basis of synchronous JK triggers of the emitter-coupled transistor logic type with bridge time-master RC-networks with recharge of capacity and diode-transistor comparator; 4) The principal circuit of a two-phase generator based on differential amplifiers with similar time-master networks. Experimental investigations of multiphase generators based on K155LAZ microcircuits (four logic elements "AND-NOT" of transistor-transistor logic type), K223TK1 (JK-trigger of the emitter-coupled transistor logic type), 122UD1A (differential amplifier), 140UD2 (operational amplifier, K176LA7 (four logic elements "AND-NOT" of KMOP type) give evidence of the stable operation of the generator in the frequency zone from tens of hertz to 10 MHz (for various types of microcircuits) with the percentage instability of frequency $\delta = 0.5 \div 3$) % with a change of temperature from -20° to +60° C and $\delta = (0.03 \div 0.1)$ % with a change of the power supply at 10% for various times. Figures 6; references: 2 Russian.
[91-6415]

UDC 621.375

INTEGRATED SEMICONDUCTOR MICROCIRCUITS FOR LOGARITHMIC AMPLIFIERS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 11, Nov 81
(manuscript received 26 Dec 80) pp 84-87

REFIN, V. V.

[Abstract] The design of logarithmic amplifiers built with integrated semiconductor microcircuits is shown, a logarithmic amplitude characteristic at frequencies above 1 MHz being attained here either by sequential detection at the output or by parallel connection of channels. A typical application is a differential video amplifier, where the operating range of input signal levels is an important parameter on which the accuracy of logarithmic operation depends. The performance of such an amplifier built with a series 174UP2 microcircuit has been calculated. Its frequency characteristic over a wide dynamic range can be improved by correction of phase shifts with additional circuitry. Addition of a resistive signal divider and two external linear amplifiers, also built with semiconductor microcircuits, increases the size only slightly but raises the noise level appreciably. The thermal stability over a wide temperature range can be improved by addition of a constant-current source, shown here in the form of a circuit with three transistors and a pair of diodes, which limits the static voltage across the load resistance to a constant level and ensures a constant gain on the nonlinear range of the transient response of the differential stage. Figures 7; references 6: 4 Russian, 2 Western (one in translation).
[155-2415]

UDC 621.383.292:519.213

STATISTICAL CHARACTERISTICS OF INERTIAL PHOTODETECTOR SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 8, Aug 81 (manuscript received 14 Apr 80) pp 80-83

RUMYANTSEV, K. Ye.

[Abstract] In view of the considerable difficulties in the analytical method of investigating the statistical characteristics of photomultiplier type photodetectors, the present work--with the use of a number of assumptions--investigates the statistical modeling of the process of photodetection. On the basis of this modeling, bounds are established for the use of normal and gamma-distribution for description of the statistical properties of photodetector signals with internal amplification. In addition, the operating characteristics are obtained for a detector of a continuous optical signal in a radiation background. Figures 2; tables 4; references: 5 Russian.
[91-6415]

COMMUNICATIONS

WIRE COMMUNICATIONS EQUIPMENT EXHIBITED AT 'SVYAZ'-81' SHOW IN MOSCOW

Moscow, AVTOMATIKA, TELEMEKHANIKA I SVYAZ' in Russian No 12, Dec 81 pp 32-35

[Article by G. Perotina: "Wire Communications Equipment"]

[Text] The "Communications Systems and Facilities" show -- "Svyaz'-81", was held 2-16 September in Moscow. This is one of the largest exhibitions of the achievements of science and technology this year. "Communications Facilities Serving Society and Man" is the slogan of the show, and characterizes the nature of the tasks facing specialists and scientists in this area.

More than 600 enterprises, organizations and companies from 23 countries participated in the show: Austria, Bulgaria, Great Britain, Hungary, German Democratic Republic, Denmark, Spain, Italy, Canada, the Netherlands, Poland, Norway, the U.S., USSR, Federal Republic of Germany, Finland, France, Czechoslovakia, Switzerland, Yugoslavia, Sweden, Japan and West Berlin.

All new equipment was displayed in the main sections of the show: satellite and radio communications equipment; television and radio broadcast equipment; terminal and channel formation equipment for wire communications; computers and instrumentation; and domestic radio equipment.

A significant portion of the displays exhibited at the "Svyaz'-81" show was made up of wire communications equipment. This includes time and frequency multiplexing equipment, fiberoptic communications link equipment, quasi-electronic and electronic automatic telephone exchanges, modern telephone and telegraph sets and teletypes, switchboards and dispatcher equipment, cables and conductors.

The exhibit of the Soviet Union was most representative in this show. It acquainted visitors with communications equipment and facilities developed on the basis of integrated technology and microprocessors, and advanced progressive technology.

The communications facilities branch of industry has achieved major successes in the years which have passed since the first show. Multichannel coaxial cable transmission systems are in use which can accommodate groups of tens of thousands of channels covering distances up to 12.5 thousand km. Digital transmission systems based on PCM and time division channel multiplexing are being used increasingly. The transmission of signals in digital form provides better noise tolerance than analog transmission, makes transmission quality independent of the length of the link, provides good technical and economic indicators and provides the capability for providing additional types of services. The IKM-30, IKM-120, IKM-480 and IKM-1920 systems were included among the exhibits of digital telephone channel multiplexing systems. This equipment can be used to transmit digital information of any kind over both cable and radio relay links.

The trend toward organizing data transmission systems and switching equipment using computer elements has now become typical. The new generations of automatic telephone exchanges -- quasi-electronic and electronic -- are controlled by computers. Significant communication and control capabilities are provided by the exhibited "Kvant" private quasi-electronic automatic branch exchange, line switching equipment for long-distance quasi-electronic exchanges and automatic switching centers, as well as the "Kvarts" zonal telephone offices. These provide additional conveniences for users, including the possibility of connecting a third party during a conversation, abbreviated dialing of frequently called subscribers, and over 20 other types of services.

One of the exhibits in the Soviet section was the VOLS-1M-120 fiberoptic communications link equipment. This system demonstrated the possibility of a data transmission method which is new in principle -- using fiberoptic cables. Fiberoptic cables differ in design in that the copper conductor is replaced with a quartz optical fiber 150 μm in diameter which is protected against mechanical effects by high-strength polymer materials and reinforcing elements. Information is transmitted over optical fibers by means of a light beam provided by a laser.

The main advantages of fiberoptic transmission systems over systems using cable links is the significantly longer repeater section, high transmission quality, low weight and long service life, insensitivity to electromagnetic interference and savings of ferrous metals. The extreme bandwidth of these links makes it possible to accommodate huge groups (several hundreds of thousands) of high frequency channels using TDM equipment, which provides the best noise tolerance. The VOLS-1M-120 system is designed for use on city, zone and main-line telephone links. The data rate is 8448 mbps.

The system for technical servicing of equipment is important for providing good communications quality. A city telephone system technical operations center was displayed at the show. This center is a system of equipment and organizational subdivisions which includes computer facilities, information for gathering and transmitting information about the status of objects being tested, testing and monitoring equipment interface devices and computer data transmitters. The technical operations center is designed to serve a zone handling up to 500,000 subscriber numbers. The center makes it possible to cut the service restoral time in half and free about 600 service personnel.

Exhibits of telegraph and facsimile communications were given a large amount of space in the Soviet section of the show. For example, pulse-code telegraphy equipment can be used to transmit signals over a wide range of speeds and to organize up to 15 duplex channels. In contrast to existing equipment, the pulse-code telegraphy system can be used to transmit information over physical lines as well as digital PCM channels. Good digital information transmission quality is maintained throughout the entire section regardless of its length, configuration or degree of technical equipment.

The duplex universal multiplexed channel formation equipment (DUMKA) attracted the attention of visitors. This equipment uses code-independent channels, with 23 carrying binary signals at 50 Baud, 4 at 200 Baud and 45 code-dependent channels for transmitting start-stop signals in MKT-2 code at 50 Baud. This equipment can be used to organize a single 50 Baud code-independent channel instead of three code-dependent channels, and can also accommodate code-independent channels with nominal 100 and 200 Baud rates by combining two or four 50 Baud code-independent channels respectively. The capability of changing the number of code-dependent and code-independent channels with different nominal transmission rates on line makes it possible to utilize the telegraph facilities more efficiently.

The new RTA-80 telegraph equipment was of significant interest to communicators. This is a page-type electronic automated telegraph set used to transmit and receive information over switched and leased channels using a five-element code, with an additional mode in which the Cyrillic and Latin alphabets can be used, in addition to the number register. Good correcting capability (45%) is another advantage of this equipment.

Photofacsimile occupies an important place in the telegraph communications system. "Izotop" and "Format" transmitting and receiving facsimile machines, as well as the TsFFA digital color photofacsimile equipment, were exhibited at the show. This equipment has various technical capabilities: the "Izotop" transmits and receives images over voice grade channels and physical links, the "Format" operates over ultrashort radio channels, and the TsFFA over digital channels. The maximum original transmission size is 220x300 mm.

One device which is small, but very necessary for the work of installers, which was exhibited at the show did not fail to attract the attention of visitors. This is the SMZh-10 multiconductor connector and press used to splice telephone cable conductors with diameters from 0.32 to 0.7 mm in polyethylene and paper insulation.

The frame of this device has a pair of clamps, a rod and an arm. The arm holds a press which is used to compress the multiconductor connection. The cable conductors are spliced and trimmed simultaneously without stripping the insulation first. The conductor connector is designed as a flat plastic receptacle with contacts on the inside with slits cut in it. The multiconductor connector increases labor productivity significantly and improves working conditions.

Communications equipment from collaborating socialist countries was exhibited extensively at the show. The largest exhibition of the socialist states was that from the German Democratic Republic.

One example of the fruitful cooperation in science and technology between the GDR and the USSR is the creation of the Unified Data System for Analog and Digital Switching (YeNSAD). The Unified Data System was represented in the form of an OL 1000 ("Istok") local communications center -- a third-generation electronic switching center. The OL 1000 is designed for use as a terminal or partial switching device, and can accommodate from 256 to 1024 subscriber lines (which may be increased to 4000). The station is processor-controlled. Many additional functions besides simply connecting two parties are executed: push-button dialing, adding third party during conversation, two-way conference calling among a maximum of seven subscribers, abbreviated dialing, call-back of third party participating in conversation, automatic re-dialing, call diverting to automatic information service, coded long-distance calling, automatic wakeup service, call waiting, etc.

One characteristic feature of the YeNSAD electronic telephone switching system is that low-frequency voice grade channels and PCM channels are switched without demodulation with the help of a spatially diverse connection field.

The OL 1000 equipment, including the central controller, are arranged in 700x275x290 mm bays. Each bay consists of five sections which are connected by plug-in central lines. A fully equipped station consists of 14 bays.

Specialists from the GDR and the USSR have developed the "Neva 1M" control system, part of which was also demonstrated at the show. This system is designed for use in the central controllers in quasi-electronic and electronic telephone exchanges.

The pavilion of the Hungarian Peoples' Republic contained wire communications equipment produced mainly by the Budavox company. City and private branch exchanges and dispatcher equipment were demonstrated, along with a TKVB family of equipment used to protect pressurized cables. One interesting exhibit was a universal device for line matching. The function of this device is to match the four-wire termination of channel circuits with a 600-Ohm line. The equipment transmits and receives the d.c. and a.c. signaling in common use which are recommended by the CCITT. These devices are placed at stations where voice grade channels are inserted or extracted.

The exposition of the Bulgarian Peoples' Republic presented a 400-number YeSK "Krosspoynt" quasi-electronic telephone exchange, along with modern telephone sets, switchboards and dispatcher communication panels. The largest of these is the KDSR-40 switchboard. This is compatible with a quasi-electronic automatic exchange, and handles up to 40 voice grade channels. Twenty subscriber lines, 20 central battery lines, 1 local battery line, 4 trunks to other automatic exchanges or manual central-battery exchanges and 1 trunk to a radio station control panel can be connected to the KDSR-40. All conversations made through the switchboard can be recorded on magnetic tape.

The collective exhibition set up by enterprises from the Yugoslavian Socialist Federated Republic presented a wide assortment of modern products from the electronic industry: telephone sets and teletypes, an electronic telephone system with four telephone sets which has the capability of adding up to 16 subscriber lines and 8 trunks, an electronic dispatcher's panel, stored-program telegraph and telephone exchanges with a digital selection stage, and electronic components, assemblies and equipment for automatic exchanges.

The communications equipment exhibited by participants from capitalist countries was also of interest.

Products bearing the brand of the Finnish L.M. Ericcson and Telenokia companies is quite familiar in this country. These companies demonstrated Diavox-system telephone sets and concentrators, as well as various types of telephone exchanges with microprocessors, including fiberoptic systems, as well as other equipment.

The current stage of development of communications technology is characterized by the use of high-speed, high-density digital memories to store rapidly changing programs. One switching system -- the DX100 automatic electronic telephone exchange -- was demonstrated at the show. This is a processor-controlled exchange.

In building up a connection, the subscriber is connected, in analog, to the concentrator, which converts the voice-frequency signals to digital form. The digital signals are transmitted from the concentrator at 64 kbps over a PCM trunk to the DX100 automatic exchange, which contains a time-division stage. The signals are then sent back to the concentrators, or transmitted over 30-channel PCM links to other exchanges.

A division of functions is provided in the DX100 equipment. The switching functions are carried out by devices which are part of automatic telephone exchanges and controlled by stored-program processors, for which backup is provided. Control and technical servicing functions are provided simultaneously for several exchanges by a single general-purpose digital computer and the peripheral devices at the technical operations center which are assigned to it. This computer has no backup, since the exchange can continue to operate if it malfunctions.

France provided one of the largest exhibits at the show. The French exhibit acquainted visitors with innovations in the area of data transmission facilities, including electronic switching systems with time and space division of channels and fiber optic communications networks. The Videotex one-way dialog system uses the telephone network to interact with a data base via a keyboard and screen.

The Sit-Alkatel company exhibited the Sitel exchange, which can accommodate 16 trunks and 80 subscriber lines. Stations with capacities ranging from 4 trunks and 12 subscriber lines to 192 trunks and 1280 subscriber lines are also produced. The Sitel automatic exchange was developed to satisfy current demands for telephone communications. Its structure is closer to that of a computer than an ordinary automatic telephone exchange. The telephone sets, external communications lines, operator switchboards and special-purpose lines all operate as terminal devices, each of which has it own interface. There is a provision for switching with space division of channels. The speech network consists of a system of channels with multistage switching (depending upon the size of the automatic exchange). The speech network and interfaces are controlled by a control and monitoring system, which in large systems consists of more than 60 microprocessors which are interconnected via a high speed information network.

The exposition from Japan was interesting. Specialists could become acquainted with a multichannel FDM transmission system, systems for transmitting digital (140 mbps) and analog data (OE-1301A optical terminal) over a fiber-optic cable, as well as the NEAX 61 digital switching system.

A great deal of original equipment, devices and instruments were presented by the FRG, Sweden, the U.S., Italy and other countries.

The "Svyaz'-81" show demonstrated the high level of current development of wire communications systems and new capabilities, as well as allowing specialists to exchange scientific and technical information.

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6900
CSO: 1860/141

UDC 621.3.018.78

COMPENSATION OF TRANSIENT PROCESSES DURING TRANSMISSION OF SIGNALS WITH ON-OFF KEYING

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 23 Apr 81) pp 52-53

BRYUKHANOV, Yu. A.

[Abstract] This brief communication shows the possibility of compensation of transient processes in a resonant amplifier stage with a parallel oscillatory circuit, during transmission of signals with on-off keying by means of the introduction of two short rectangular pulses with a duration τ_k connected in amplitude and phase with an amplified signal with the duration τ, at the moments of beginning and end of this signal. A method is proposed for combating distortion which is more effective than the simple expansion of the bandwidth of an amplifier because the latter is inevitably combined with a simultaneous increase of noise. The results of the work can be used during creation of a shaper of amplitude modulated signals. Figures 2; references: 1 Russian.
[90-A-6415]

UDC: 621.3.052

DATA TRANSMISSION IN SPECIALIZED PUBLIC DIGITAL NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 82
(manuscript received 19 Aug 80) pp 28-31

KARPINSKIY, M. A., OSIPOV, V. G. and SAFONOV, I. K.

[Abstract] The design decisions made during creation of a data transmission network must correspond to the latest trends in the development of communications equipment, because such networks remain in use for decades. For this reason, networks currently planned should use primarily digital transmission techniques. This article presents a classification of digital data

transmission networks with channel switching. Topics covered include methods of insertion of signals and network characteristics, selection and justification of network types. It is concluded that synchronous digital networks are most promising, although they require synchronization systems for all elements of the network. The characteristics of three types of digital network designs are presented, indicating that synchronous networks have characteristics superior to asynchronous networks. Figures 1; tables 1; references 8: 2 Russian, 6 Western (1 in translation).
[173-6508]

UDC 621.317.5

METROLOGICAL SUPPORT OF RADIO RELAY LINE: UNIFIED COMPLEX OF SPECIAL MEASURING EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 81
(manuscript received 24 Mar 81) pp 48-54

ZUDAKIN, A. I.

[Abstract] A complex of special control-measuring equipment was developed for measurements of channels, routes and equipment for radio relay lines (RRL). The complex includes more than 30 special devices and items which assure the principal required measurements in the range of ultrahigh to low frequencies. The following items are described and technical data and photographs are furnished: 1) Watt-meters for RRL transmitters; 2) Noise testing complexes for RRL receivers; 3) Pulse reflectometers for measurements of reflections in waveguide tracts; 4) Complex for measurements of differential and frequency characteristics; 5) Measurers of agreement at intermediate frequencies (ISPCh); 6) UNR-1 device (control modulator--demodulator [Modem]); 7) Measurer of transient interference; and 8) Measurer of losses of reliability IPD-1 with converter of code and impedance PKI-1. It is concluded that use of the special control-measuring complex makes it possible to increase the level of technical servicing of RRL. Figures 8; tables 5; references: 5 Russian.
[142-6415]

TEST OF USE OF LOW-NOISE TRANSISTOR AMPLIFIERS AT HIGH-LEVEL RADIO RELAY STATIONS

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 81 pp 56-57

SALIBEGASHVILI, V. V. and KARAPETYAN, T. G.

[Abstract] The work concerns a number of stations operated with radio relay lines of the Georgian SSR at great heights and at difficult to reach

places. Organization of reliable electrical supply at such stations and the creation at them of normal conditions for taking care of personnel are extremely complex problems. In connection with this, passive retranslators (PR) are used more and more. Difficulties in using PR are discussed. The cost of such a PR is great and it is practically impossible to arrange a series of two PR because of the large losses in the power of the microwave signal. Consequently, it is necessary to search for new ways for creation of reliable radio relay stations for high-level rayons. In 1979 specialists of the Georgian SSR Ministry of Communication worked on replacement of high-level radio relay stations with low-noise microwave transistor amplifiers. A description of the reconstructed station and its equipment is presented.
[142-6415]

UDC 621.372.018.78

EFFECT OF PROBABILITY DISTRIBUTION OF MULTICHANNEL SIGNAL ON TRANSIENT INTERFERENCE IN CHANNELS OF MULTICHANNEL TRANSMISSION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 81
(manuscript received 26 Nov 80) pp 32-35

BORODIVH, S. V.

[Abstract] The paper is concerned with an investigation of the effect of a deviation of the distribution of a multichannel signal from the Gaussian on the magnitude of transient noise. An accumulative analysis of a transformation of arbitrary random processes and an analysis of transient interference with the aid of accumulant functions are considered and a quantitative evaluation is made. It is concluded that the analysis conducted shows that a nonuniform charge can give rise to a noticeable increase of the transient interference because of a deviation of the distribution of a multichannel signal from the Gaussian only in systems of low capacity (less than 300 channels of tone frequency [TF]). In systems with a capacity of 300 channels of TF and more, the probability distribution of instantaneous values of multichannels signals is always very close to Gaussian. Hence it also follows that the difference of magnitude of transient interference with a real charge from the magnitude measured with a "white" noise load in systems of large capacity can be initiated only by the nonuniformity of the energy spectrum of a multichannel signal and a corresponding charge of the magnitude of the function $Y_2(\sigma)$ and $Y_3(\sigma)$. However, this reason requires special investigation. References: 3 Russian.
[142-6415]

UDC 621.376.4

SOME SPECIAL FEATURES OF AUTOCORRELATION RECEPTION OF SIGNALS WITH PHASE-DIFFERENCE KEYING

Kiev IZVEWTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript received 25 Mar 80, after revision 29 Oct 80) pp 50-53

OL'SHEVSKIY, N. N. and ZAYKOV, S. P.

[Abstract] At present two methods are used for reception of signals with phase-difference keying (PDK): the method of comparison of polarities or synchronous reception and the method of comparison of phase or autocorrelation reception. Synchronous reception for detection of a PDK signal requires creation of a reference voltage. During autocorrelation reception the PDK signal received, retarded for the duration of an elemental message, is used as a reference voltage during detection. The specific advantages of autocorrelation reception before synchronous are known, among them instantaneous entry into communication, smaller dependence of operating characteristics of equipment on the precision of regulation and simplicity of equipment. However, in spite of the advantages mentioned, autocorrelation reception in practice does not as yet find wide use during operation with high speeds. Some reasons for this are considered in the present. A low-frequency equivalent during autocorrelation reception of PDK signals is considered. Replacement of the circuit modulator-channel-detector by a low-frequency circuit makes it possible to simplify analysis of the effect of frequency distortions of the channel on the quality of the transmitted discrete signal. The noise immunity of a single system of transmission of binary signals with autocorrelation reception is discussed. The dependence of the probability of errors on the signal-to-noise ratio for an autocorrelation receiver of PDK signals is determined. It is shown that with an increase of the transmission rate at the output of the detector of an autocorrelator receiver a complication takes place of the transient processes in comparison with a synchronous receiver. As a result of this process of build-up of a signal is delayed, which leads to an additional decrease of the noise immunity. Figures 4; references: 3 Russian.
[91-6415]

UDC 621.376.33:621.376.52

INVESTIGATION OF FINE STRUCTURE OF LINEARLY FREQUENCY MODULATED SIGNALS WITH INTRAPULSE PHASE-SHIFT KEYING

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 28 Dec 80) pp 66-69

DOLGOV, V. I., BELOV, S. P. and GORBENKO, I. D.

[Abstract] Certain properties of linearly frequency modulated (LChM) signals with intrapulse phase shift keying (LChM-FM) are considered in a

paper by V. N. Kochemasov, V. P. Kryazhev and V. S. Okoneshnikov (RADIOTEKHNIKA, Vol 35, No 2, Feb 80), which shows the advisability of a deeper study of the properties of a given class of complex signals. In particular, practical use of LChM-FM signals, especially under conditions of frequency-limited channels, requires precise knowledge of their spectra, which in the above paper were investigated insufficiently completely. An analysis of the effect of the base of a constituent element of the LChM-FM signal ($B_{s.e} = \Delta F\tau_E/N$) on the form of its amplitude and phase spectra is also of definite interest. The present brief communication is devoted to a detailed evaluation of the fine structure of the distortions of LChM signals as a result of their phase-shift keying. It is shown that phase modulation of LChM radio pulses appears in a change of the amplitude spectrum and a residual phase term. In three figures, graphs are presented of the dependences constructed on a foundation of the results of calculations on a digital computer by means of formulas derived in the work. Knowledge of the special features of the fine structure of the spectra of LChM-FM signals makes it possible to use them accurately in communication systems for various purposes. Figures 3; tables 1; references: 3 Russian.
[90-A-6415]

UDC 621.383.52:621.396

SENSITIVITY ANALYSIS OF OPTICAL COMMUNICATION RECEIVERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript received 9 Jun 80, after revision 20 Nov 80) pp 3-9

KORNEYCHUK, V. I.

[Abstract] The principal characteristics of optical communication receivers are the signal-energy: the threshold power of the optical signal and the quantity of photons for the binary unit of information required for attainment of threshold. The present work investigates the dependence of signal-energy of photodiode receivers of direct detection on the width of the transmission band. The possibilities are discussed of using p-i-n photodiodes, avalanche photodiodes, and preamplifiers based on field-effect and bipolar transistors. A generalized equivalent circuit is shown and explained of a photodiode receiver for signal-energy. Parametric improvement of sensitivity (decrease of threshold power), and the optimum width of the transmission band are considered. It is shown that there exists an optimum (in the energy sense) width of the transmission band, with which the sensitivity of an analog receiver is closest to the theoretical limits, and for the digital, a minimum number of photons is required for an impulse. Figures 3; references 10: 3 Russian, 7 Western.
[91-6415]

UDC 621.391

ANALYSIS OF TWO-STAGE PROCEDURE FOR SEARCH OF PSEUDORANDOM SIGNAL

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 19 May 80) pp 2456-2459

BONDARENKO, V. N.

[Abstract] The two-stage procedure for search of a compound pseudorandom signal

$$s(t) = \sqrt{\frac{2P}{1+\alpha}}\,[\sqrt{\alpha}\,S_1(t-\tau)\cos\theta(t) + S_2(t-\tau)\sin\theta(t)]$$

is analyzed and evaluated. Here $S_1(t)$ and $S_2(t)$ are binary pseudorandom signals with different numbers of symbols per period and different symbol lengths each, both assumed to be ideal periodic autocorrelation functions and the cadence frequency of the second signal a multiple of that of the first one, parameter α characterizes the power division between the two signals, τ is the time delay, and $\theta(t)$ is the carrier phase. Both signals are searched for with a single-channel correlational detector. In the first stage a sequential search for the first signal in the asynchronous mode occurs. The resulting indeterminacy of the time delay is removed in the second stage, during sequential search of the second signal. If the latter is not found at any one possible pickup point, the first stage is repeated at the next possible pickup point. The procedure can be optimized with respect to the signal-to-noise ratio and the mean maximum search time in this procedure is then at least 100 times shorter than in the conventional step-by-step procedure. Tables 1; references: 2 Russian.
[94-2415]

UDC 621.391

SINGLE-CHANNEL COMPENSATORS OF RADIO INTERFERENCE IN COMMUNICATION SYSTEMS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 11, Nov 81
(manuscript received, after completion, 16 Apr 81) pp 25-31

BYKHOVSKIY, M. A.

[Abstract] At the input of a receiver there generally appears the sum of a useful signal and an interference signal, mixed with additive white noise. The basic variant of an optimum interference compensator consists essentially of two reception branches, one for each signal, with an optimum demodulator whose high-frequency output is connected to one input of subtractors. The synthesis of such a compensator is based on the equation for the maximum-likelihood estimator of the input process. The structure can be simplified depending on the specific form of signals, particularly for amplitude-modulated or frequency modulated ones, and depending on their relative

magnitudes. A suboptimum interference compensator, based on an approximate equation, is often adequate in the case of small useful signals with large interference signals. With successive approximations, it will approach the optimum one through iterations. Conventional devices include only one iteration stage, their interference immunity being lower than that potentially attainable but higher than that of plain demodulators. Devices are available for separating AM signals and for separating FM signals, also for separating differently modulated signals. Adaptive filters, on the other hand, are linear systems and can separate useful and interference signals only when they occupy very different frequency bands. Figures 6; references 24: 12 Russian, 12 Western (one in translation).
[155-2415]

UDC 621.391

EVALUATION OF SIGNAL REPRESENTATION ERRORS DURING THEIR CONVERSION INTO DIGITAL FORM WITH AID OF DEVICE FOR MULTILEVEL CLIPPING

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript received 6 Dec 79, after revision 23 Feb 81) pp 73-78

ROG, A. I. and SIROTA, A. A.

[Abstract] Accomplishment of analog-digital conversion is necessary during input of signals into a computer in order to solve various kinds of problems. One of the possible means of increasing the speed of response and simplification of a system of analog-digital conversion is to realize them on the basis of the principle of multilevel clipping (MLC). A device for MLC is a combination of M parallel-connected comparing devices, fulfilled for example in the form of biased limiters with which the values of the cut-off voltage are in accord with the levels of clipping. A 1975 report from the literature points out that such a method of fixation of the signal level at a given moment of time makes it possible to attain a potential for the elementary base of the speed of response. Sampling can be accomplished parallel with the output of each scanning device by the method of filling the duration of the frequency pulse of a timing oscillator. The present work is concerned with an investigation of the errors which originate during accomplishment of these conversions and, in particular, an investigation of the effect of the number of clipping levels on errors of sampling. Analytical expressions are obtained for an evaluation of the average linear error of transform and an evaluation of the root-mean-square error of transform. It is shown that the proposed approach to determining the errors of digital presentation, based on an analysis of the probability characteristics of intersections by the signal of the clipping level, makes it possible to obtain a simple evaluation of the errors as a function of the number of levels and the number of quantization readings for a wide class of signals which are described as differentiable random processes. Figures 4; references: 6 Russian.
[91-6415]

UDC 621.391.2

AVERAGE POWER SPECTRUM FOR PULSE RANDOM PROCESSES WITH DETERMINED TIMING INTERVALS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript 22 Apr 80, after revision 2 Feb 81) pp 31-38

PLETNEVA, T. G., ROZORINOV, G. N. and EYDEL'MAN, S. D.

[Abstract] The present work is devoted to a total solution of the problem of computation of the average power spectrum of a pulse random process, controlled by an arbitrary ergodic Markov chain. In so doing the facts of the theory of finite Markov chains set forth in a 1970 item from the literature are substantially utilized. The mathematical proof of all passages to the limits is conducted within the bounds of the theory of generalized functions. In passing, cases are investigated with which calculation of an averaged power spectrum can be substantiated within the bounds of classic analysis. The formulas obtained make it possible with satisfactory effectiveness to calculate the averaged spectra of signals significant in practice. Figures 3; references 13: 11 Russian, 2 Western.
[91-6415]

UDC 621.391.82

ALGEBRAIC PROPERTIES OF COMPLETE CODE OF DISCRETE FREQUENCY SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 25 Feb 80, after revision 22 Jan 81) pp 2296-2300

VLASOV, A. V. and MATVEYEVA, O. V.

[Abstract] Discrete frequency signals are regarded as the most promising type of noiselike signals for radio engineering applications. Here the properties of such signals are examined from the algebraic standpoint, first-order discrete frequency signals and the corresponding code being defined in terms of sequence of nonrepeating elements subject to addition and multiplication. The group properties are established on the basis of four theorems, according to which the complete code can be split into non-intersecting subsets. Each of those represents an optimum system of discrete frequency signals. Thus a standard method becomes available for formation and interchange of such systems with excellent correlation characteristics. Tables 1; references 5: 4 Russian, 1 Western (in translation).
[94-2415]

UDC 621.391.244

DISCRETE ANHARMONIC FOURIER TRANSFORMATION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81
(manuscript received 14 Apr 80, after revision 16 Jun 80) pp 102-104

SARYCHEV, V. T.

[Abstract] In the last few years, during study of multibeam propagation of short-wave radio waves, wide use has been made of a Doppler method based on division of the beams by a frequency shift. However, the discrete Fourier transformation (DFT) used in the process cannot rigorously solve the number of the frequency components of the signal, and consequently it is not possible with sufficient precision to determine the parameters of these components. In the present short communication an algorithm is proposed based on the discovery in N-dimensional space of a plane of minimum dimensions, the projection of the initial vector on which is maximum. The stages of the procedure of spectral analysis are listed. For approval of the algorithm, a model signal from four lines was analyzed. A table presents the results of the analysis. The upper half of the table corresponds to the initial signal, and the lower half presents the values of a component of the signal, calculated on the basis of the proposed algorithm. For comparison, a figure presents the spectrum of DFT and the spectrum of the initial signal. Tables 1; references: 1 Russian.
[91-6415]

UDC 621.391.278

NOISE IMMUNITY OF OPTIMUM DIVERSITY RECEPTION WITH CORRELATED INTERFERENCE

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 4 Mar 81) pp 36-39

KHVOROSTENKO, N. P. and SHISHKIN, Yu. V.

[Abstract] A 1968 work by N. P. Khvorostenko (see above) investigated methods of diversity reception, optimum for uncorrelated adaptive Gaussian noise in the diversity branches. In accordance with the theorem of reciprocity found in a 1969 work from the literature, these methods also remain optimum in the presence of correlation adaptive noise in the diversity branches if first of all the oscillations received are linearly transformed for decorrelation interference. The noise immunity of diverstiy reception with such a transformation is considered. The methods considered for analysis of the noise immunity of optimum diversity reception with correlated interferences illustrate the simplest case of the use of known

relationships, obtained earlier for uncorrelated interference. For other concrete models of diversity reception it is possible significantly to increase the class of methods. As an example, for a coherent method of demodulation signals, it is possible to use the results of a 1974 work of which N. P. Khvorostenko is coauthor. References 6: 5 Russian, 1 Western in translation.
[90-A-6415]

UDC 621.391.278:621.317.361

NECESSARY BANDWIDTH OF DOPPLER RATE METER

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 25 Mar 81) pp 41-44

DVOYNIN, V. N.

[Abstract] This brief communication demonstrates that the desired bandwidth of the receiver of a Doppler rate meter is determined by the width of the signal spectrum and the permissible error of measurement of the rate in a receiver with a constant frequency of adjustment and a permissible error $\delta\nu \leqslant (0.05...0.1)\%$ (ν = rate) with the use of individual adjustments and pairs of coupled circuits, the desired bandwidth must be in a 30...40 times wider maximum width of the spectrum of the input signal and depends but little on the number of circuits. Use of automatic fine adjustment of frequency makes it possible considerably to decrease the desired bandwidth. In order to decrease the bandwidth it is necessary to increase the stability of the frequency of adjustment of the narrow-band channel of the receiver and to decrease the residual detuning of the circuit of automatic fine adjustment. In a receiver with such adjustment during use of pairs of coupled circuits, the desired bandwidth is 3...4 times less than with the use of individual adjusted circuits, which it is possible to explain by a better approximation of the amplitude-frequency characteristics of the coupled circuits to the ideal П-shaped AFC. Figures 3; references: 5 Russian.
[90-A-6415]

UDC: 621.397.27

SIGNAL ADJUSTMENT DURING DATA TRANSMISSION BY TWO-PULSE METHOD

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 82
(manuscript received 28 May 80) pp 35-38

TAMM, Yu. A.

[Abstract] The two-pulse method is a promising one for the use of correlated signals in data transmission. The cosine spectral shape characteristic

for two-pulse signals allows data transmission through channels with large local bursts of linear signal distortions within certain areas of the transmission band. The two-pulse method requires redesign of adaptive signal correction circuits. A modified correction method is suggested for these signals. The harmonic correction device suggested is suitable for the two-pulse method as well as other signal types with correlation among signal samples. Figures 7; references 5: 3 Russian, 2 Western.
[173-6508]

UDC 621.396.43:621.372.632

CALCULATION OF PERMISSIBLE LEVELS OF NOISE OSCILLATORS AND MICROWAVE RADIO RELAY LINE AMPLIFIERS

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 81
(manuscript received 30 Jul 81) pp 35-37

PANOVA, R. K., TURKEVICH, A. A. and YAKOVLEV, A. P.

[Abstract] One of the sources of noise which effects the quality of operation of radio relay communication equipment is the noise of oscillators and microwave amplifiers resulting from the amplitude and frequency of the signal. As applied to the equipment "Electronics Communication," the permissible level of noise of the oscillators and microwave amplifiers introduced into the tone-frequency channels is evaluated as having a magnitude of 10-20 picowatt. However, for assignment of requirements for the level of nonstability of the signals of oscillators and microwave amplifiers it is insufficient to indicate only the integral power of the noise. The most informative parameters which characterize the quality of signals of microwave devices is the spectrum of their instability. It is concluded that the analysis conducted in the present work of the effect of the nonstability of oscillator and microwave signals on the parameters of a radio relay line shows that they introduce a significant interference into communication channels. The formulas obtained in the work make it possible to calculate the permissible noise levels of oscillators and microwave amplifiers, as well as the permissible magnitudes of the pulsations of power sources. Quantitative determination of these quantities with the aid of a nomogram considerably facilitates the establishment of requirements for the instability oscillations of microwave devices and for pulsations of their power sources. Figures 1; references 6: 5 Russian, 1 Western.
[142-6415]

UDC 621.396.62

EFFECT OF MODULATION FORM ON PERMISSIBLE VALUES OF SENSITIVITY OF DISCRETE SIGNAL RECEIVER

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 1 Apr 81) pp 49-51

BREUS, A. I.

[Abstract] The introduction of new techniques for long-distance radio communication and work conducted on automatization of radio receiving centers requires scientifically substantiated methods of measurement and standardization of the unified parameters for radio receiving devices. Certain aspects of this problem have been considered in the literature. Thus, for example, a 1971 work states that the "normal value of a unified parameter is different for a different form of the signals. These relations are insufficiently studied. The greatest difficulty is determination of the permissible limits of change of the parameters." During recent years the state of the problem has changed but little, and the urgency has increased in connection with problems of control automation. The present brief communication considers the effect of the real sensitivity of a receiver of discrete signals on the probability of error and the reliability of a channel with respect to noise immunity. The following items are examined: 1) Connection of the generalized parameters of a receiver of discrete signals with the probability of error during fluctuating interference; 2) Effect of generalized parameters on reliability of operation of channel during fluctuating interference; and 3) Effect of modulation form. Figures 2; references: 10 Russian.
[90-A-6415]

UDC 621.396.66

ERROR DISTRIBUTION AND EFFICIENCY OF INTERFERENCE-IMMUNE CODING IN SHORT-WAVE RADIO CHANNEL

Moscow RADIOTEKHNIKA in Russian Vol 36, No 11, Nov 81
(manuscript received 12 Nov 80) pp 75-79

BLEYKHMAN, V. S., MIKHAYLOV, Ye. F., PUGACH, A. B. and TSVIGUN, A. V.

[Abstract] Multifrequency modems are used in short-wave radio channels for data transmission at 1200-4800 baud rates with minimum multiple beaming. The reliability is improved by increasing the multiplicity of modulation, relative phase modulation or combined amplitude-phase modulation. The interference immunity decreases then, however, as a result so that special codes are required. An experimental study on the use of block codes was made in August and September 1975 on a 3500 km long latitudinal short-wave

radio trunkline, for the purpose of collecting statistical data on error distribution and code efficiency. The particular modem with 24 channels operated with single or double relative phase modulation, transmitting data at rates of 1200 or 2400 baud respectively. Messages were sent over 10 ms duration signals, with 1.16 ms duration protective intervals, while subchannels were manipulated at the rate of 100 baud. Tests were performed around the clock with a 15 kW single-sideband radio transmitter and a birhombic transmitter antenna, with the two receiver antennas of the traveling-wave type staggered in space. Multiple beaming did not exceed 1.5 ms and the signal-to-noise ratio remained within the 15-35 dB range in the radio channel. The data on the distributions of error multiplicities have been processed in the comprehensive form of "generalized" probabilities. The results indicate that the interference immunity does not significantly depend on the length of the code combination, when the relative redundancy remains constant. From the standpoint of decoder simplicity, however, "short" codes are preferable. A comparative evaluation reveals also that the use of such a code is much more efficient than conventional data duping in frequency-staggered modem channels. Figures 5; tables 3; references 5: 2 Russian, 3 Western (in translation).
[155-2415]

UDC 621.396.96

ONE METHOD OF ANALYZING SCANNING STRATEGIES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 4 Sep 80) pp 2308-2314

YEGOSHIN, Ye. I. and SULIMOV, A. O.

[Abstract] An analysis of scanning strategies is proposed, by a method which assumes a finite number of alternative hypotheses $h_1,\ldots,h_n$ about the state of possible elements in the set sought, tested at discrete instants of time. A resolver controls the scanning process in one of $q_1,\ldots q_k$ ways and with one of $v_1,\ldots,v_n$ decisions about the validity of hypotheses $h_1,\ldots,h_n$. The analysis of strategies implies calculation of the mathematical expectations (costs) of functions (penalties) in the realization of the search process, such a function being called density of strategy characteristics. A strategy characteristic is defined in terms of a point in space of a priori information. The concept is demonstrated on the zeroth-order, the first-order, and the second-order characteristics. After the stability of a strategy has been established, these characteristics are calculated on the basis of an integral equation utilizing the sufficiency of the statistics. Typical results are shown for nonrandomized strategies of seeking an object "hidden" in one of n channels, by scanning only one channel at a time. The authors thank P. A. Bakut for helpful discussion. Figures 2; references: 5 Russian.
[94-2415]

UDC 621.396.96:621.391.26

SYNTHESIS OF DIGITAL ADAPTIVE REJECTION FILTERS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 13 Oct 80) pp 53-57

POPOV, D. I.

[Abstract] During processing of signals on a background of passive interference, the potentialities of one of the basic operations--rejection of the spectral components of interference--are incompletely realized because of the absence of a priori information concerning the spectral--correlation properties of interference as well as their nonuniformity and nonstationariness in the zone of review. Methods of overcoming a priori indefiniteness are based on adaptive methods, to which pertains a widely distributed method, based on the principle of correlation feedback. However, an adaptive algorithm on the basis of direct circuits, constructed in accordance with the adaptive Bayes' manner, possesses known advantages from the point of view of the indices of a transient regime. Examples of adaptive devices of interperiod compensation (method of processing signals at the output of a coherent-pulse radar station conducting selection of moving tragets) with an immediate evaluation of the Doppler phase are considered in 1975 and 1978 reports from the literature. Major potentialities are possessed by full adaptation to the correlation properties of interference--to the modules and arguments of the coefficients of interperiod correlation. The present short communication presents a method for synthesis of digital adaptive rejection filters which realizes the maximum effectiveness for a selected order of filter. It was shown that the method proposed makes it possible to synthesize adaptive rejection filters which are realized under conditions of a priori indeterminancy with respect to the correlation properties of the interference limit or the desired effectiveness of the selection of effective signals with minimum duration of the adaptive process. Figures 2; references 7: 6 Russian, 1 Western.
[90-A-6415]

UDC 621.396.666

INCREASE OF RATIO OF RECOVERY TIME TO SETTLING TIME IN AUTOMATIC GAIN CONTROL

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 31 Mar 81) pp 77-79

ZAKIROV, V. I. and VOROB'YEV, B. F.

[Abstract] Devices for automatic gain control (AGC) are widely used in various types of radio engineering equipment in order to assure a small change of the signal level at the output with large changes of the signal

level at the input. The settling time of the transmission coefficient, the recovery time, as well as their ratio, pertain in particular to the principal parameters of an AGC device. An increase of the ratio of the recovery time to the settling time makes it possible to reduce the noise level of the linear channel of radio communication in the intervals of information reception. In the present brief communication the functional circuit of a proposed AGC, which possesses a large magnitude of this ratio in comparison with well-known AGC devices, is presented and explained. It is shown that in an AGC device, by means of the introduction of a supplementary detector with a small time constant and a comparison device, which assures a change of the amplification factor of the feedback circuit, it is possible to obtain an increase of the ratio of the recovery time to the settling time of 10 or more times with simultaneous suppression of noise in the intervals of information reception. Figures 2; references 4: 2 Russian, 1 USA, 1 Japanese.
[90-A-6415]

UDC 621.375.121

INVESTIGATION OF AMPLITUDE-FREQUENCY CHARACTERISTICS OF MULTIPLEXER AMPLIFIERS WITH CONTINUOUS FREQUENCY BAND

Kiev IZVESTIYA VYSSHIKH UCHENBYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81 (manuscript received 31 Mar 80) pp 24-31

MIKHAYLOV, V. S.

[Abstract] An effective method of improving the parameters of broadband amplifiers is the synthesis of continuous amplitude-frequency characteristics (AFC) on the basis of multichannel filters with a fixed input resistance—multiplexers. A description and theoretical consideration of multiplexer amplifiers (MA) with successive selection of channels is presented in 1973 and 1975 works from the literature. However, practical realization of such devices is restrained by a number of noninvestigated problems, in particular those connected with the construction of continuous AFC with prescribed properties. The present work analyzes MA and on the basis of numerical methods of processing the results, the dependences are established of the nonuniformities of AFC on a variation of formation of the structural scheme and parameters of the multiplexer: the degree of the approximating polynomial of the transfer function, and the coefficient of overlap with respect to frequency in the limits of the channels and the magnitude of the mutual agreement of adjacent bands. Two basic variations of the structure of synthesized amplifiers are considered which have an identical element complexity. These are: 1) A variation with uniform multiplexers at the input and output of the amplifier; and 2) A variation with unlike multiplexers at the input and output of the amplifier. The results of calculation and experimental verifications are presented. The resulting AFC of a synthesized MA with a continuous frequency band was obtained on the basis of an analysis of the amplitude and phase characteristics of compound channels. Figures 6; references: 5 Russian.
[91-6415]

UDC 629.7.04

PROCEDURE FOR CONTROL TOLERANCES COMPUTATION FOR PARAMETERS OF RADIOELECTRONIC OBJECTS OF GIVEN FUNCTIONING QUALITY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA
in Russian Vol 24, No 8, Aug 81 (manuscript received 24 Dec 80) pp 90-92

STUPAK, S. D. and DORONKIN, Ye. F.

[Abstract] A method is proposed for determining the control tolerances for the initial values of the parameters of control objects which makes it possible to assure fulfillment of a requirement with respect to the reliable functioning of specimens of radioelectronic equipment during a given time with a given probability. Figures 2; references: 4 Russian.
[91-6415]

UDC 621.383.52:621.396

MACHINE MACROMODEL OF SEMICONDUCTOR MICROCIRCUIT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 8, Aug 81 (manuscript received 21 Feb 80, after revision 8 Sep 80) pp 94-96

MEL'NIK, A. S.

[Abstract] At present, macromodeling of microcircuits (MS) is accomplished in two ways: Experimental investigation of exterior characteristics, and preliminary modeling of a MS network at the component level with a subsequent simplification. The obvious advantages of the second method is the use of a digital computer instead of a large quantity of special equipment, and the small expenditure of nonautomated labor. This makes it preferable at the present-day level of development of systems of automatized planning. The present paper considers a method of constructing machine micromodels as illustrated by an analysis of the K134LR1 microcircuit which fulfills the logical operation "2 AND-NO." A table presents some indices of machine analysis of the K134LR1 microcircuit with the use of a complete model and a macromodel for comparison. The method described for development of machine macromodels of the semiconductors of microcircuits of a low degree of integration has the following advantages: 1) Use of a program of machine analysis of a system for automatized planning. 2) Decrease of time for constructing micromodels. 3) Possibility of automatization of all stages of construction of macromodels. 4) Modeling of real input and output characteristics of logical microcircuit. Figures 2; tables 21 references: 1 Russian, 1 Western.
[91-6415]

UDC 681.3.087.92:621.327

MULTICHANNEL DATA ASSEMBLY SYSTEM WITH DIGITAL CORRECTION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 81 pp 65-67

VLASOVA, V. V., KONIKOV, A. I. and MAZOV, I. N.

[Abstract] The block diagram of a circuit often used in data assembly systems is presented. The circuit has a defect: because of the non-idealness of the analog memories (AM), the drift of zero and change of the scale have individual values for each of the channels, especially during operation in a wide temperature range. A method of correction of zero and scale is considered which makes it possible to liquidate this defect. An enlarged block diagram of the new system is presented and explained. The system can be realized using a microprocessor of the 589 series. The merits and demerits of digital correction with the aid of a microprocessor are discussed. It is shown that the proposed method is most effective in multichannel systems with increased requirements on metrological characteristics. Figures 3; references: 2 Russian.
[139-6415]

UDC 621.373.072.9

BLOCK OF SYNCHRONIZED MICROWAVE OSCILLATORS OF 9 AND 36 GHz BAND

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received 12 Mar 81) pp 81-83

METSNER, Ye. P.

[Abstract] Synchronized oscillators are widely used in various radio measuring devices and systems and systems for frequency stabilization. In particular, such a device is used in an installation for investigation of the dispersion of the dielectric constant of substances, during which for obtaining signals synchronized with respect to frequency a sufficiently powerful ($P_{output} = 200$ mW) microwave oscillator is employed, the principal part of the power of which comes from a frequency multiplier, at the output of which signals of the harmonics are received, which are utilized together with part of the power of the microwave oscillator for excitation of measuring units. With a multiplicity of frequencies equal to four and more, such an approach has little effectiveness because of an inadequacy of the signal power at the output of the multiplier. The present short communication presents the results of an investigation of a block of synchronized microwave generators of the 9 and 36 GHz band. A block diagram of the device is presented and explained. It is concluded that use of synchronization makes it possible on a base of low-power microwave oscillators to obtain satisfactory characteristics of a block of microwave oscillators for measurement of the dispersion of the dielectric constant of substances. Figures 3; tables 1; references 6: 4 Russian, 2 Western.
[90-A-6415]

ELECTROMAGNETIC COMPATIBILITY

UDC 534.143:534.874.1

PROPAGATION OF ACOUSTO-ELECTROMAGNETIC PULSES IN LIMITED PIEZOCRYSTAL

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA
in Russian Vol 24, No 10, Oct 81
(manuscript received 9 Sep 80, after completion 30 Apr 81) pp 1267-1275

GILINSKIY, I. A. and VDOVIN, V. Ye., Institute of Semiconductor Physics, Siberian Branch, USSR Academy of Sciences

[Abstract] Piezoelectric crystals are widely used in various communication devices and information processors. Clear understanding of the special features of wave processes originating during excitation of signals in piezocrystals is absolutely necessary for successful creation of such types of devices. The present report is concerned with a mathematical formulation of the problem, one restricted to the simplest situation, and it is considered that the source has an infinite extension along the axis Oz, and the problem is two-dimensional. It is assumed that the piezocrystal belongs to class 6mm(C_{6v}) and that only transverse waves, polarized along the axis of symmetry of the sixth order (axis Oz) are excited. General formulas are derived which desiribe propagation of acousto-electromagnetic waves, and electromagnetic fields created by a short pulse are thoroughly studied. Figures 1; references 5: 3 Russian, 2 Western (1 in translation).
[132-6415]

ELECTRON DEVICES

UDC 537.311.33

SOLAR CELLS WITH GaAs-AlGaAs HETEROJUNCTIONS AT HIGH LEVELS OF OPTICAL EXCITATION

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 51, No 12, Dec 81 (manuscript received 12 Mar 81) pp 2550-2553

ALFEROV, Zh. I., ARIPOV, Kh, K., YEGOROV, B. V., KOROLEVA, N. S., LARIONOV, V. R., NULLER, T..A., RUMYANTSEV, V. D. and FEDOROVA, O. M., Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] The results are given of a study of the load volt-ampere characteristics of solar cells with GaAs-AlGaAs heterojunctions with high levels of optical excitation. Solar cells were fabricated with an n-GaAs(111) A substrate with $N_D \simeq 1.3 \cdot 10^{17}$ cm^{-3} and a liquid epitaxial film of $Al_xGa_{1-x}As$ ($x \sim 0.75$) about 30 μ thick doped with zinc to a concentration of $N_A \simeq 5 \cdot 10^{18}$ cm^{-3}. The zinc was diffused into the substrate in the growing process and the junction was shifted a depth of about 1 μ from the heteroboundary. The wafers produced measured 22 X 24 mm. The contact grid in the p-region was in the form of a round collector with a diameter of 10 mm and a system of radial and concentric strips with an average distance between them of 200 μ. The wafers were coated by means of anodic oxidation and grooves were etched into the p-AlGaAs film. The fabrication process included photolithography, spraying of the Au + Zn contact alloy, brazing and narrowing down of the grid by means of indium. Fifteen percent of the surface was covered by the contact and the test samples were soldered onto copper holders. Optical excitation was performed either by means of an ISK-25 flash tube or by placing the samples at the focal point of a spherical mirror concentrating solar radiation. Flash tube excitation of the samples was employed to eliminate uncontrollable heat effects. A determination was made of the region of linearity of the short-circuit current with an increase in excitation level extending to densities of approximately 20 A/cm^2. With the temperature fixed and the illumination varying, curves were plotted for the dependence of the no-load voltage on the short-circuit current density. Curves were then plotted for the no-load voltage as a function of temperature at various current densities. The highest efficiency, equaling 21.6 percent, was gotten with a solar radiation

concentration factor of 130. With this factor equaling approximately 1000 an efficiency of approximately 17 percent was obtained. Solar cells 10 mm in diameter generate 8 W of electric power with a solar radiation concentration factor of 916. It is possible to increase the power to 16.6 W by increasing the diameter to 17 mm. The authors thank V. M. Andreyev, M. B. Kagan and S. V. Ryabikov for helpful recommendations and V. M. Tuchkevich for constant attention to the work. Figures 4; references 8: 4 Russian, 4 Western.
[191-8831]

UDC 539.219.1

INVESTIGATION OF STRUCTURAL IMPERFECTIONS OF EPITAXIAL FILMS OF GALLIUM ARSENIDE AND THEIR EFFECT ON SCHOTTKY-BARRIER CHARACTERISTICS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 8, Aug 81 (manuscript received 12 May 80, after revision 21 Nov 80) pp 100-102

KLEBANOVA, N. A., NOSIKOV, S. V., SMELOVA, A. A. and CHERNETSKIY, T. P.

[Abstract] The present short communication is concerned with an investigation of defects in films used for preparation of semiconductor devices, as well as an evaluation of their effect on the electrophysical properties of the Schottky barrier. The epitaxial structures $n-n^+$ obtained by the method of gas-transport reactions at a (100 plane) were investigated. The thickness of the epitaxial layer amounted to 0.2-3.5 micrometer, and concentration of a doping impurity (tellurium) in the film—6.10^{16} cm^{-3}, in the substrate 2 : 4 .10^{18} cm^{-3}. During the investigation the methods were used of selective etching, optical and scanning electron microscopes, and x-ray microanalysis. It is established that series-produced gallium arsenide films contain various structural defects, the density of which can reach 10^6 cm^2, in particular: 1) Volume dielectric connection; 2) Regions containing silicon; and 3) Defects developed during etching in the form of dome--shaped mounds. Using as an example diodes with a Schottky barrier, an electrical activity of exposed defects is established: 1) The dielectric connections produce an increase of the forward resistance of a Schottky barrier; 2) Dome-shaped mounds correspond to regions with an increase of recombinations of carriers and are responsible for an increase of leakage currents of diodes; and 3) Local formations with silicon leads to a reduction of the mobility of the carriers. The direct interconnection between the output of suitable devices and the defectiveness of the raw material is shown. Standards are established for the suitability of the epitaxial structure for a particular diode with a Schottky barrier. On the basis of the investigations it is possible to affirm that the presence, even if of one defect in the active region of the structure, can lead to a change of the parameters of the semiconductor structure. Investigation of the epitaxial gallium arsenide films with a scanning electron microscope is effective for control of an electrically active structure of defects during

use for selective etching of the composition: 33% water solution CrO_3:HF=1:2. The procedure developed is used for control of epitaxial films in industry. Figures 3; references 4: 1 Russian, 3 Western. [91-5415]

UDC 621.3.032.217

PHOTOCATHODES WITH NEGATIVE ELECTRON AFFINITY IN TRANSMISSION MODE OF OPERATION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 5 May 80) pp 2409-2420

YASNOPOL'SKIY, N. L. [deceased] and BALASHOVA, A. P.

[Abstract] The development through the 1969-79 period of semitransparent GaAs photocathodes with negative electron affinity is reviewed. The main design and performance characteristics of these devices on GaP or glass substrates with or without ternary-compound (AlGaAs, GaAsP, InGaP) interlayers, produced by gaseous-phase or liquid-phase or hybrid epitaxy, are summarized. Their integral and spectral photosensitivities are important, as well as the dependence of both on the thickness of the active layer, on the length of the diffusion path in it, and on the recombination rate at its boundary. Although an integral photosensitivity of 900 μA/lm is attainable with glass-GaAlAs-GaAs photocathodes operating in the transmission mode, i.e., illuminated on the opposite side of the emitting surface, photocathodes made of self-supporting thin silicon single crystals have an integral photosensitivity up to 1500 μA/lm but also an undesirable high dark conductivity. Figures 6; tables 3; references 29: 3 Russian, 26 Western (one in translation). [94-2415]

UDC 621.313.322-81

TWO-DIMENSIONAL AND THREE-DIMENSIONAL MODELS OF CRYOTURBOGENERATOR

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 12, Dec 81 (manuscript received 27 Jun 80, after completion 1 Sep 81) pp 1328-1335

KOS'KIN, Yu. P., TROFIMOV, Yu. A, and TSEYTLIN, L. A.

[Abstract] In the majority of studies of the magnetic field and parameters of cryoturbogenerators a 2-dimensional calculation model is used in which the axial dimensions of the machine are considered infinite and the field of the windings plane-parallel. A few studies utilize a 3-dimensional

model of a closed region bounded by shields with idealized physical characteristics. The 2-dimensional model has certain advantages over the 3-dimensional model in that it makes it possible to analyze problems relating to shielding and to obtain a qualitatively correct picture along with the quantitative characteristics of all they key processes of a cryoturbogenerator. But the 2-dimensional formulation of the problem involves an error. This question is studied here, where a comparison is made of the key equations in the 2-dimensional and 3-dimensional models on the basis of an analysis which takes into account the finiteness of the length of a cryoturbogenerator's windings. A machine without shields is studied here, and a study of a machine with shields will be published later. A simplified design diagram of the machine is considered, in which it is assumed that the stator's winding is a 3-phase system of coils laid onto a cylindrical surface and forming a specific number of pairs of poles, the active parts of the coils are directed along their generating lines, and the front connections are bent along the arcs of individual circles. The rotor winding consists of coils of the same form laid onto a cylindrical surface and the direct current flowing through them, alternating in direction, creates a symmetric system with twice the number of poles as the stator winding. The stator and rotor current are regarded as surface sheets of current and the linear current density in these sheets is assumed to be a piecewise discontinuous function of the azimuthal angle. The steady-state mode of operation of the machine is studied, in which the rotor turns at a synchronous velocity of $\Omega = \omega/p$, where ω is the angular frequency of the stator's current and p is the number of pairs of stator winding poles. In the 2-dimensional formulation of the problem expressions are derived for mutual inductances, the e.m.f. corresponding to them, power and momentum which are valid for any length of the rotor's winding and therefore for a model with a rotor of finite length. It is shown that in the 3-dimensional model all key quantities characterizing the operation of a cryoturbogenerator with a stator and rotor of finite length can be obtained from expressions previously found for the 2-dimensional model by multiplying by individual factors. These factors can be used both for estimating errors characteristic of the 2-dimensional formulation of the problem and for adding appropriate corrections when necessary. Figures 3; references 5: 4 Russian, 1 Western.
[169-8831]

UDC: 621.317.772

USE OF DIGITAL ADDER IN HIGH-SPEED PHASE-VOLTAGE CONVERTERS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81
(manuscript received 3 Nov 80) pp 91-93

KHIL', V. V.

[Abstract] The speed of phase-to-voltage converters (PVC) in which signal frequency division is used to expand the range of unambiguous phase

reading can be significantly increased by the use of binary codes formed at the outputs of all bits of the frequency divider as the measurement and reference pulse sequences arrive at the inputs of the dividers. It is desirable to use frequency dividers of different structures, the outputs of which carry information on phase changes in the measurement and reference channels of the converter in direct and complement codes. A structural diagram of a PVC using a digital adder is presented and studied. A schematic diagram of the device and time diagrams of voltages at various points in the converter are presented. An emitter follower circuit is used to decrease the influence of external circuits on the results of measurement in the PVC. As the frequency of the oscillations increases, the significance of delay in the adder and switching phenomena in the internal digital-analog converter increases, resulting in distortion of the converter characteristic shape and a decrease in the measurement accuracy. The frequency at which the distortions become significant depends on the degree of expansion of the limits of unambiguous reading. Figures 3; references 3: 2 Russian, 1 Western.
[172-6508]

UDC 621.373.01:621.382.2.029.64

DESIGN OF OSCILLATOR WITH GUNN-EFFECT DIODE IN DOMAIN-QUENCHING MODE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 25 Apr 80) pp 2472-2475

ORLOV, V. B. and YAKIMOV, A. V.

[Abstract] The performance of a microwave oscillator with a Gunn-effect diode is analyzed on the basis of its equivalent parallel circuit. The oscillator has been designed to ensure operation with domain quenching, namely that the sum of bias d.c. voltage and microwave a.c. voltage across the diode will drop below the domain dissipation threshold within the domain transit time. Both current-voltage and charge-voltage characteristics of the diode have hysteresis. The performance characteristics of such an oscillator, the dependence of steady-state amplitude and frequency on the diode voltage at various values of the diode conductance in a weak electric field, are calculated from short equations for the amplitude and the phase of self-excited voltage oscillations. Typical numerical data are shown. Figures 3; references 3: 1 Russian, 2 Western.
[94-2415]

UDC 621.382.3

IMPROVEMENT OF STEADY-STATE MODEL OF MDP-TRANSISTOR IN MICROMODE

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 31 Mar 81) pp 9-15

YAKIMAKHA, A. L.

[Abstract] One of the most promising solutions to stepping down of the energy consumed during development of integrated MDP-IC is the use of a micromode MDP-transistor with a weak inverse near-the-surface layer of a semiconductor substrate. The present paper reviews USSR and foreign work in this field. Because these works reflect the principal directions in the development of the theory of the depletion mode of a MDP-transistor, then for their analysis it is obviously impossible to create a functionally complete theory of a micromode without use of simplifying assumptions and subsequent "joining" of the results obtained. Such assumptions are used concerned with separation of substrate current of MDP-transistors operating in the depletion mode of two components: 1) Current of metallurgical p-n junction of source-substrate; and 2) Current from the lateral surface of induced p-n junction. An effective value of the m_{ef}-factor is also introduced, taking into consideration recommended processes in semiconductor substrates, analytical expressions are obtained for the effective value of the m_{ef} factor with consideration given to the effect of the temperature of the substrate-source. Experimental results confirmed the principal theoretical aspects forecasting the strong dependence of the m_{ef} factor on the temperature and voltage of the substrate-source with forward voltages at the electrode of the substrate and the weakness of its dependence on temperature and voltage of the substrate-source with inverse voltages of the substrate-source. The theoretical and experimental investigations of the m-factor of a MDP-transistor can be used during construction of temperature-to-voltage converters, as well as development of temperature-stable micropower inverters which it is possible to use in superlarge integrated circuits. Figures 2; tables 1; references 11: 6 Russian, 5 Western.
[90-A-6415]

UDC: 621.383.6;53.088

ERROR IN OPTOELECTRONIC MEASUREMENTS CAUSED BY NONPARALLEL PROPAGATION OF LIGHT BEAM RELATIVE TO AXIS OF COAXIAL KERR CONVERTER

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 1, Jan 82 (manuscript received 24 Feb 81) pp 89-91

KUZHEKIN, I. P., candidate of technical sciences, and KANKIYA, R. R., engineer, Order of Lenin and Order of the October Revolution Power Engineering Institute, Moscow

[Abstract] The use of a coaxial Kerr converter for measurement of short high-voltage pulses has a number of advantages over the plane-parallel units. However, additional errors arise, which this article analyzes. The analysis is based on the assumption that the light beam has the same cross section and intensity throughout the length of the converter. The phase shift between the ordinary and nonordinary rays at the output of the converter depends on the dimensions of the converter and the deviation in propagation of the beam from a line parallel to the converter axis. The phase shift changes with a change in the angle of deflection of the light beam. The equations presented can be used to determine the error caused by nonparallelism of the beam relative to the axis of the cell. The paper was presented by the Department (Kafedra) of High-Voltage Techniques. Figures 3; references: 1 Russian.
[170-6508]

UDC 621.385.63

TRAVELING-WAVE TUBE WITH TRANSVERSE FIELD: RESULTS OF STUDY AND THEIR ANALYSIS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 11 Nov 80) pp 2365-2369

VANKE, V. A., ZAYTSEV, A. A., NIGMATULLIN, U. A., SAVVIN, V. L. and YUR'YEV, V. I.

[Abstract] An experimental study was made of traveling-wave tubes with a transverse synchronous wave of the electron beam. The laboratory models had a unisegmental metal-ceramic structure with liquid coolant and included a solenoid producing a magnetic field for focusing the solid-cylindrical electron beam. A maximum efficiency of 20% was attained at a gain of 12.5 dB and an output power level of approximately 2 kW, with a beam current of 0.8 A and an accelerating voltage of 12 kV. In this particular tube this performance was obtained with an input power of 110 W and an electron beam with a mean radius of 2 mm. The transverse coupling resistance was 50 ohm, the cyclotron frequency was 1.08 times the signal frequency and the initial

beam velocity was 1.06 times the phase velocity of the wave in the retarding system. The performance of this tube was also calculated theoretically, assuming successively a 0, 5%, 10% initial spread of electron velocities in the beam. The closest agreement between theoretical and experimental data corresponded to a 5% spread. Figures 4; references: 5 Russian.
[94-2415]

UDC 621.391.822:535.215.2

FLICKER NOISE IN SEMICONDUCTOR FIELD-EMITTER CATHODES

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 10 Sep 80) pp 1276-1281

BAKHTIZIN, R. Z. and GOTS, S. S., Bashkir State University

[Abstract] The results are presented of an investigation of the flicker noise of silicon and germanium photosensitive field emitter cathodes. The principal experiments were fulfilled on p-type monocrystals with a resistivity of 14, 500, 1000 and 2000 ohm.cm (Si) and 30 ohm.cm (Ge), the surface of which was cleansed by field effect desorption. The volt-ampere characteristics of such field emitters are substantially nonlinear and have the characteristic photosensitivity of a saturation regime. The field emitter device is a video-changed field electronic Myuller microscope with a shielded collector grid. The initial vacuum in the device was not worse than 10^{-9} tor. Based on the results obtained, the concept of surface centers of emission is considered. A theoretical definition is presented for the relation between structural and time parameters of the emitter surface and the spectral characteristics of fluctuations. Figures 4; references 14: 9 Russian, 5 Western (1 in translation).
[132-6415]

LIGHT-EMITTING DIODES

Moscow RADIO in Russian No 11, Nov 81 pp 57-60

AKSENOV, A., IVANOV, V. and YUSHIN, A.

[Abstract] This article, intended to be clipped and saved in a notebook, describes the operating principles, basic parameters and physical dimensions of commercially produced LED's available in the Soviet Union. Tables of data present type numbers, color and intensity of light, voltages required, maximum spectral distribution and standard markings. Drawings illustrate the physical dimensions, sizes and shapes of the most common types of LED's. Figures 14; tables 8.
[171-6508]

INDUSTRIAL ELECTRONICS & CONTROL INSTRUMENTATION

UDC 621.382

GALLIUM ARSENIDE DIODE THYRISTORS PRODUCED BY GAS PHASE EPITAXY

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 51, No 12, Dec 81
(manuscript received 24 Dec 80) pp 2581-2582

ASTAFUROV, A. G., ASHKINAZI, G. A., BOTNARYUK, V. M., DIAKONU, I. I.,
ZHILYAYEV, Yu. V., IVANOV, L. P. and CHELNOKOV, V. Ye., Physicotechnical
Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] The results are given of a study of a diode thyristor based on gallium arsenide and produced from the gas phase. The diode thyristor has a 4-layer $p^+-n^o-p^+-n^+$ structure and was produced by gas phase epitaxy by the chloride method in a horizontal growth system. The precise procedure is described in a 1971 study by Yu. V. Zhilyayev (see above). A gallium arsenide substrate doped with zinc and oriented in plane [100] was used as the p-emitter. The high-impedance n-type base had a concentration of $5\cdot10^{14}$ to $5\cdot10^{15}$ cm^{-3} and was 20 to 55 μ thick in various samples. The p-type base measured 7 to 12 μ and was doped with zinc to a concentration of (1 to 3)$\cdot10^{17}$ cm^{-3}. The concentration of tin in the n^+-emitter equaled $5\cdot10^{17}$ cm^{-3} and diffusion lengths equaled 10 to 14 μ for holes and 6 to 8 μ for electrons. Switching voltages at room temperature reached 280 V and residual voltage at the holding current equaled 1.3 to 2.5 V. Samples tested measured (1 to 16)$\cdot10^{-2}$ cm^2 with switching currents of 0.05 to 2 mA and holding currents of 100 to 500 mA. Light-control characteristics were plotted using an LG-38 laser with a wavelength of 0.63 μ as a light source with the light striking the sample's face. The results demonstrate that these diode thyristors are effectively controlled by light even at low power. Temperature dependences of the switching voltage were studied and it was shown that the switching voltage decreases with an increase in temperature. Studies of transient processes demonstrated that with the minimum amplitude of pulses, switching the diode thyristor the length of current buildup fronts equaled 10 to 50 ns. This length was reduced severalfold with an increase in the amplitude of pulses. The recovery time equaled 0.3 to 1.0 μs under direct current of 600 mA. Figures 2; references: 6 Russian.
[191-8831]

UDC: 531.383

TWO CHANNEL FIBER INTERFEROMETER FOR STUDY OF NONMUTUALITY PHENOMENA IN SINGLE-MODE FIBER LIGHT GUIDE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 8 Spp 80) pp 168-169

BAZAROV, Ye. N., IZRAYELYAN, V. G., SVERCHKOV, Ye. I. and TELEGIN, G. I., Institute of Electronics and Radio Engineering, USSR Academy of Sciences, Moscow

[Abstract] To determine the most significant causes of nonmutuality in single-mode fiber light guides, a two-channel fiber interferometer was constructed in which light can propagate through the single-mode fiber light guides in two opposite directions. Any external influence on the light guide acts on both waves, but the waves can be analyzed independently. Both polarization and phase measurements can be performed. As external conditions such as temperature change, the parameters of the output radiation from the opposite ends of the light guide may differ from each other. Curves are presented of the rotation of planes and ellipticity of polarization of two oppositely directed waves as a function of temperature. The nature of the curves depends essentially on the point at which the light guide is heated, mechanical effects on the guide and the type of guide used. Figures 2; references 6: 2 Russian, 4 Western.
[172-6508]

UDC: 535.42; 681.142.622

'DISK' NEUTRON DIFFRACTOMETER CODING DEVICE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 23 Apr 80) pp 62-63

GOLOVIN, A. Ye. and TYUGIN, A. B.

[Abstract] The "Disk" diffractometer, utilizing a parallel-series method of recording, employs a closed circular system of 256 type SNM-31 detectors

located at a uniform spacing around a disk and rotating through 360° during the course of measurement, providing for a minimum angular spacing of $360°/2^{15}$. The differences in individual characteristics of the detectors do not influence the accuracy of relative intensity measurements, meaning that the diffractometer can be used even with failure of a significant number of the detectors. The operation of the coding device is described. As the device operates the detector number is converted to a binary code which is sent to a detector number adder. The total time of conversion, adding and recording is about 3.3 μs. Figures 1; references: 9 Russian.
[172-6508]

UDC: 537.228.4

INSTALLATION FOR STUDYING KERR EFFECT AT LOW TEMPERATURES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81
(manuscript received 26 Jun 80) pp 158-160

TYURIN, S. A., KHASHCHINA, M. V., MATVEYEV, V. I. and
KALINICHENKO, Ye. A., Khar'kov Polytechnical Institute

[Abstract] An installation has been created in order to study electrooptical phenomena in a substance successively in three physical states. The device allows the Kerr effect to be studied in a variable electric field in the 78 to 400 K temperature interval at pressures of 0 to 100 atm. The birefringence which develops in the Kerr cell is recorded with a signal-to-noise ratio no worse than 5:1. A block diagram of the device and cross sectional drawing of the Kerr cell are presented. Observation of the Kerr phenomenon requires high accuracy of orientation of the planes of the interelectrode gap at an angle to the plane of polarization of the transmitted light beam. The device was tested by measuring curves of the variation of Kerr constant as a function of temperature for three industrial freons. Figures 3; references 4: 3 Russian, 1 Western.
[172-6508]

UDC 538.56:519.25

STATISTICAL DESCRIPTION OF DIGITAL FREQUENCY-TIME MEASUREMENTS

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 10, Oct 81
(manuscript received 15 Jul 80, after completion 5 Mar 81) pp 1245-1251

SAICHEV, A. I. and SHEPELEVICH, L. G., Gor'kiy State University

[Abstract] At present, measurement of many physical magnitudes reduces ultimately to measurement of frequency or a period of harmonic oscillations,

i.e., to frequency-time measurements. Today a digital-type electronic frequency meter (DTFM) serves as the principal device for frequency-time measurements. A block diagram is presented of a DTFM and its principal elements are described. Two basic operating conditions of the DTFM are considered: The regime for measuring frequency, and the regime for measuring a period. The problem is studied of expressing the statistics of the phase fluctuations with quasi-monochromatism of the reference and investigated signals. It is shown that the method of calculation of the statistics of measurement of time intervals is substantially different with natural and technical phase fluctuation. The authors thank A. N. Malakhov for helpful discussions. Figures 1; references: 6 Russian.
[132-6415]

UDC: 539.219.1.012:543.45.772.9

APPLICATION OF HOLOGRAPHIC INTERFEROMETRY METHODS TO TEST OPTICAL HOMOGENEITY OF HIGHLY REFRACTIVE TRANSPARENT MATERIALS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 12 Apr 80) pp 171-173

GAVRILOV, V. A., KUTVITSKIY, V. A., MECHEV, V. V., IL'INYKH, V. Ye. and BUZOVKIN, V. P., Krasnoyarsk Institute of Nonferrous Metals

[Abstract] It is difficult to find immersion media for testing of highly refractive transparent materials with an index of refraction over 2.0. The present work describes a method allowing the optical heterogeneity of transparent materials to be studied using an immersion medium with an index of refraction differing significantly from that of the specimen. Studies were performed by holographic interferometry of focused images in two stages. In the first stage, a plane parallel measurement cuvette was placed in one arm of the interferometer containing the specimen and a plate exposed, after which the cuvette was filled with the immersion medium and reexposure performed. As a result when the image was restored an interferogram was produced which was a function of the topography of the specimen. Points were selected at random on the specimen and the distribution of thickness of the material determined for them. The optical path difference could then be determined between a point and any other point on the specimen. In the second stage the specimen was reexposed, removed from the interferometer and the plate exposed again. This interferogram was a function of the distribution of index of refraction of the object and of its heterogeneities in thickness. An equation can be derived for the optical path difference between any two points. This allows investigation of the optical heterogeneity of transparent materials without optically flat parallel surfaces. Figures 2; references 5: 4 Russian, 1 Western.
[172-6508]

UDC: 621.317.757:681.32

RADIO SPECTROMETER FOR LOCATION OF WEAK SPECTRAL LINES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81
(manuscript received 8 Oct 80) pp 123-126

KONOVALENKO, A. A., Institute of Radio Physics and Electronics,
USSR Academy of Sciences, Khar'kov

[Abstract] A description is presented of a spectral analyzer designed for locating low-intensity spectral lines in cosmic radiation. The high-frequency section utilizes a type R-155P receiver (1-30 MHz band, 128 KHz intermediate frequency, 5-50 KHz bandwidth, noise factor ~5). The spectrometer utilizes switching of the input signal, alternately connecting the signal being studied and a reference noise generator to the input of the receiver through a diode switch. A reversing counter has been developed for the analyzer. The characteristics of the radio spectrometer are presented. The device is mounted on 115 x 140 mm^2 printed circuit boards. The device achieves a resolution on the order of 1 KHz with an accuracy of 1 part in 10,000 for counting times on the order of 1 day. The author thanks L. G. Sodin for formulation of the problem and for discussion. Figures 2; references 2: 1 Russian, 1 Western.
[172-6508]

UDC 621.322.5

MEASUREMENT OF S-PARAMETER OF TRANSISTOR IN LARGE SIGNAL REGIME

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81
(manuscript received after completion 24 Apr 81) pp 63-65

TOROPOV, Ye. B.

[Abstract] The present brief communication proposes a procedure for measuring the S-parameters of a transistor in a large signal regime with maintenance of the identity of the regime and theclosenness of it to real conditions of operation in a device, a block diagram of which is shown in a 1968 report from the literature [Muller, O. NTZ, 1968, No 10] (with use of artificial mismatch at the output). Measurements can be made with both matching at the input and output, and with mixmatching of the operation of the transistor at the input and output. The measuring procedure is based on the use of measuring device, a block diagram of which is shown in the brief communication, and is explained. References 6: 5 Russian, 1 Western.
[90-A-6415]

UDC 621.375.1

WAYS TO SYNTHESIZE PARALLEL HIGH-FREQUENCY CHANNELS FOR CORRECTION OF INTEGRATED-CIRCUIT OPERATIONAL AMPLIFIERS

Moscow RADIOTEKHNIKA in Russian Vol 36, No 11, Nov 81
(manuscript received 27 Nov 80) pp 89-91

TSYGANKOV, V. A.

[Abstract] The intrinsic amplitude-frequency characteristic of integrated-circuit operational amplifiers must usually be corrected so as to ensure an adequate stability margin in the linear range with a large feedback factor. Correction with frequency-dependent passive RC circuits in the feedback loop limits the response speed, while the limited range of the intrinsic uncorrected characteristic still limits ate gain area. Correction with a parallel passive or active high-frequency channel across one stage of a multistage operational amplifier ensures a high response speed of the latter. One possibility is to connect a wideband voltage repeater in series with a corrective capacitor between the inverting input and the output of the first stage. This, in effect, shifts the pole of its transfer function toward lower frequencies and introduces a zero. Sometimes a corrective capacitor alone suffices, but then an additional negative feedback for the amplifier is needed for compensating parasitic local positive feedback. In the case of noninverting or differentially connected operational amplifiers, correction can be achieved with a circuit such as one shown here consisting of five n-p-n (or p-n-p) transistors and a pair of diodes, all on a single series 198NT1(5) integrated-microcircuit chip. Modifications are possible, depending on the type and the application of a particular operational amplifier. Figures 3; references: 3 Russian.
[155-2415]

UDC 621.375.826.089.68

DIGITAL MEASURING DEVICES FOR WORKING STANDARDS AND CALIBRATION MEASURING MEANS FOR AVERAGE POWER AND ENERGY OF LASER RADIATION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 81 pp 41-45

GORELIKOV, N. I., ZAGORSKIY, Ya. T., KOTYUK, A. F. and KUZNETSOV, A. A.

[Abstract] This work considers the characteristics and errors of the most accurate of highly-sensitive digital measuring devices (TsIP) and the possibility of their use in measuring-recording complexes of working standards and in the composition of calibrating measuring means. An analysis of the characteristics is conducted both with respect to reference data and data of technical conditions, and with respect to that obtained as a result of experimental investigations of a number of TsIP. Figures 5; tables 1; references: 8 Russian.
[139-6415]

UDC: 681.785:681.12.121

FIBER-OPTICAL FLUID LEVEL SENSOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 18 Nov 80) pp 197-198

VOLOKHOV, V. N., ZHABOTINSKIY, M. Ye., MORSHNEV, S. K., RYABOV, A. S., FRANTSESSON, A. V. and YANKOVSKIY, E. S., Institute of Radio Engineering and Electronics, USSR Academy of Sciences, Moscow

[Abstract] A fiber-optical liquid level sensor is described which uses the disruption of conditions of total internal reflection at the boundary between the light guide and the surrounding medium which occurs when the index of refraction of the medium changes, e.g., at the boundary between liquid and gas. A photograph of an experimental model of the sensor is presented. Each sensor consists of a U tube and several different lengths must be used to measure the fluid depth in a container. The devices are light in weight and have the advantage of being nonelectric in operation and thus spark safe. Figures 2; references: 1 Russian.
[172-6508]

MAGNETICS

UDC 550.83.084:621.3.095

DEVICE FOR CONTINUOUS RECORDING OF POLAR AIR CONDUCTANCES IN 0.01-1.0 HERTZ RANGE OF GEOMAGNETIC PULSATIONS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 81 pp 67-68

STRUS', A. I. and GAN'SHIN, V. I.

[Abstract] The expansion of investigations of atmospheric electricity, and processes in the surface layer of the atmosphere connected with the electrode effect gave rise to interest in measurements of the variations of intensity of the electrical field, the conduction current of atmosphere-earth, and the electrical conductivity of the air λ in the range of geomagnetic pulsations. In the surface layer of the atmosphere where the influence of the electrode effect is significant, it is necessary to conduct a simultaneous and continuous recording of polar conductance (positive and negative) in a given frequency band with a sufficiently low level of intrinsic noise. The most fully imposed requirements satisfy the method of an aspiration condenser utilized in devices developed at the Main Geophysical Observatory imeni A. I. Voyeykov for discrete recording of polar air conductances. The present work describes a device intended for continuous recording of polar air conductances and their variations at frequencies from 0.01-1.0 Hz. A block diagram of the device is presented. It consists of a transducer, a switching unit, and equipment for aspiration of (drawing) air. The transducer switches off into itself two measuring channels which make it possible to record simultaneously the electrical conductivity of the air stemming from the presence of positive and negative ions. The channels are identical and consist of an aspiration condenser which accomplishes air-current conversion and an electrometric amplifier which fulfills the function of current-voltage conversion. The principal sources of error of the device are: nonuniformity of the amplitude-phase characteristics of the higher frequency bands of the measuring channel, amplifier noise, temperature drift of "zero", interference signal, induced on the collecting electrode of the aspiration condenser because of the effect of the exterior electrical fields (antenna effect). The device underwent tests and is recommended for stationary observations of the electrical conductivity of atmospheric air. Figures 2; references: 3 Russian. [139-6415]

UDC 621.3.029.65

EXCITATION OF MAGNETOSTATIC WAVES AT 30-40 GHz FREQUENCIES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 10 Nov 80) pp 2381-2389

STAL'MAKHOV, V. S., IGNAT'YEV, A. A. and KULIKOV, M. N.

[Abstract] Excitation and propagation of volume and surface magnetostatic waves in the 30-40 GHz frequency range are analyzed on the basis of theoretical relations and experimental data. In electrodynamic terms, a metal-dielectric-ferrite-dielectric-metal multilayer structure serves as a transmission line for both types of magnetostatic waves. The dispersion characteristics of such a structure are calculated from the equation of motion, including a loss factor, for a magnetic moment in an external magnetic field, with a magnetostatic potential satisfying the Fokker equation inside the ferrite and the Laplace equation outside the ferrite. In the experiment a ferrite single crystal was placed near the center of a waveguide and oriented parallel to the narrow walls, with the waveguide at this location driven beyond cutoff for the operating frequencies. The effect of losses is analyzed on the basis of calculations and measurements as the ratio of dielectric thickness to ferrite thickness increases from $t/d \ll 1$ ($t/d = 0$ corresponds to no dielectric layers) through $t/d = 1$ to $t/d \gg 1$ ($t/d \to \infty$ corresponds to no metal shields). The results indicate the feasibility of excitation of both volume and surface magnetostatic millimeter waves with equipment including a standard waveguide and a matching transformer. Figures 7; references 10: 6 Russian, 4 Western.
[94-2415]

UDC 537.531:621.3.029.6

EXPERIMENTAL STUDY OF EFFECT OF RIPPLES ON MICROWAVE-RADIATION CHARACTERISTICS OF WATER SURFACE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 24 Sep 80) pp 2291-2295

ANTIPYCHEV, M. A. and SHUTKO, A. M.

[Abstract] An experimental study was made of radiothermal radiation reflected by water with surface ripple. Measurements were made with horizontally, vertically, or circularly polarized incident radiation at 2.25, 3.2, 8.5, 18, 30 cm wavelengths in the laboratory, at 2.25, 3.2, 8.5 cm wavelengths in a basin, at 0.8, 3.4 cm wavelengths from a coastal point, and at 0.8, 2.25, 3.2, 8.5, 18, 30 cm wavelengths from an airplane, under meteorological conditions ranging from clear sky to rain. Full ripple was generated by wind or artificially by a fan. The results reveal an increment of surface brightness in the centimeter-wave band caused by small-scale ripple components under natural conditions, an increment which varies with the angle of vision and does not exceed 3 K. It is a monotonically decreasing function of the angle of vision, with the latter measured from the vertical, and remains positive in the case of horizontal polarization but changes sign at about 68° in the case of vertical polarization. The spectral characteristic of this brightness increment or contrast in the centimeter-wave band is a power-law relation with the exponent 0.47 approximately. The results also reveal a dependence of the radiation brightness temperature increment on the azimuthal angle. Figures 4; references 11: 9 Russian, 2 Western.
[94-2415]

UDC: 681.335

ECONOMIC ANALOG-DIGITAL SUCCESSIVE APPROXIMATION CONVERTERS BASED ON INTEGRATED MICROCIRCUITS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 14 Jul 80) pp 88-90

BASALAYEV, G. V. and GLEMBA, V. I., Institute of Physics and Mechanics, Ukrainian Academy of Sciences, L'vov

[Abstract] An 8-bit analog-digital converter (ADC) with a power consumption of about 100 mW is based on series 564 integrated circuits. These circuits are used to implement both an ADC and a digital-analog converter (DAC). The conversion format provides an acceptable ratio between speed and accuracy. The DAC utilizes a matrix consisting of a resistor and electronic switches. Conversion time is 12 μs. A second ADC is based on MSI technology achieving a board size of 80 x 80 mm^2. This is a 12-bit device and achieves a conversion time of 30 μs. Figures 4.
[172-6508]

UDC 621.372.852

INVESTIGATION OF CONTROLLED WAVE EXCITATION OF HIGHEST TYPE IN RECTANGULAR WAVEGUIDE WITH SYMMETRICAL FERRITE AND FERRITE-DIELECTRIC STRUCTURE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 21 Nov 80) pp 1291-1292

KOROBKIN, V. A., DVADNENKO, V. Ya. and VELIKOTSKIY, V. N., Khar'kov State University

[Abstract] As stated in 1978 by V. A. Korobkin (see above) and N. A. Khizhnyak, use of waveguide-dielectric resonators (WDR) assures a promising combination of small dimensions and high electrical parameters of microwave devices. Use of the coupled oscillators of a WDR makes it possible to realize a number of new high-quality small dimension frequency-selective microwave devices, e.g., double-band filters with small losses and high selectivity, as well as electrical-retunable filters, operating with resonance controlled magnetic fields and with an increased level of input power. The present short communication is concerned with an investigation of structures which assure realization of a coupling controlled by an exterior magnetic field between types of waves in a WDR, and the optimum parameters of a structure for obtaining the maximum magnitude of such a coupling. Figures 2; references 3: 2 Russian, 1 Western.
[132-6415]

UDC: 621.373.027.9:621.3.029.64

SYNCHRONIZED MICROWAVE GENERATOR BASED ON BIPOLAR TRANSISTOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 29 Sep 80) pp 132-133

PETROV, G. V. and KHRAMOV, A. V., Moscow Engineering-Physics Institute

[Abstract] The generator described in this article utilizes a circuit with a separate input and output. The main advantage of this type of generator over reflective-type generators is the possibility of producing a broader band of synchronization, as well as a lower level of FM noise. A schematic diagram of the generator is presented. The transistor used has strong internal feedback, sufficient to place it in an area of potential instability. The presence of this feedback greatly simplifies design and practical implementation of the generator, eliminating additional elements which would otherwise be required in order to reduce the stability of the transistor. The maximum synchronization band is 0.33 GHz, level of maximum output power 10 mW with input power $\leqslant 1.5$ mW, maximum gain 13.8 dB, nonuniformity of output power in 3.4-3.6 GHz band 4 dB. Figures 1; tables 1; references 4: 1 Russian, 3 Western.
[172-6508]

UDC 621.382.333

USE OF SILICON P-I-N STRUCTURES FOR RADIATION CONTROL AT 1.15 MICROMETER WAVELENGTH

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 16 Jan 81) pp 2467-2469

GRODNENSKIY, I. M., DYUZHIKOV, I. N., OGLOBLIN, I. O., SOKOLOV, Yu. F. and STAROSTIN, K. V.

[Abstract] An experimental study was made in order to determine the feasibility of using silicon for modulation of the radiation intensity near the edge of fundamental absorption, i.e., near the 1.1 micrometer wavelength for this material. Specimens of standard p-i-n diode structures for modulation of microwave radiation were used, with the thickness of the weakly doped p-layer and n-layer respectively 10 and 50 μm thick. Excess charge carriers were injected into the base region by passage of current pulses in the forward direction and the absorption of 1.15 μm radiation from a He-Ne laser by those carriers was measured with the aid of a germanium avalanche photodiode. The absorption coefficient $\alpha = -\log(\Delta J/J)/L$ (J- radiation transmitted by silicon diode in the absence of current, ΔJ- change of radiation transmitted after transient period during passage of current pulse, L- dimension of the mesa base region in the direction of light

propagation) was found to depend on the current density, increasing proportionally to the latter from 0 to 0.15 at $j = 30\ A/cm^2$ and then at a decreasing rate at 4 at $j = 3600\ A/cm^2$. The absorption pulse, with both a risetime and a falltime of 0.15 micrometer, lagged slightly behind the current injection pulse. The results indicate the feasibility of using standard silicon p-i-n structures as amplitude modulators of optical radiation in fiber-optics systems, their effectiveness increasing with increasing carrier-radiation wavelength. Figures 2; references 7: 6 Russian, 1 Western (in translation).
[94-2415]

POWER ENGINEERING

GROWING CRYSTALS FOR HIGH-VOLTAGE EQUIPMENT

Leningrad LENINGRADSKAYA PRAVDA 12 Dec 81 p 1

[Article by A.Belikov: "Crystal for Electrical River"]

[Text] Future power bridges are now called super-long power transmission lines. These are lines such as the Ekibastuz-Tsentr LEP-1500 line which stretches almost 2,500 kilometers from near the Irtysh to the Volga. Many scientific-technical and planning organizations in Leningrad are participating in the development of superhigh-power high-voltage equipment for this line. The collective of the All-Union Scientific-Research Institute of High-Frequency Current imeni V.P. Vologdin is making an important contribution to solving this problem. Unique equipment and technology are being developed here for growing single crystals of silicon needed for creating high-voltage equipment.

When talking about crystals, we usually imagine sparkling multifaceted granules. What I saw at the Department of Growing Equipment of the VNII [Scientific-Research Institute] of High-Frequency Current in no way corresponded to the accustomed measures. The massive dull shining cylinder -- weighing about 5 kilograms -- which was lying on the desk of department head V.I. Dobrovol'skaya was... a crystal or, more precisely, a single crystal containing a single crystal lattice throughout its entire body.

"This single crystal, 125 millimeters in diameter, is the largest which has ever been obtained in this country," explains Viktoriya Ivanovna. "The thin sheets into which it will be cut will provide the basis for current conversion devices. The larger the sheets, the higher the power of the devices and, finally, the more economical and reliable the operation of equipment on power transmission lines."

New, more powerful solid-state current converters will be installed in the high-voltage section of the Ekabastuz-Tsentr power transmission line. Each of these units will replace three of its predecessors, and the amount of metal required will be reduced by a factor of three.

"The Institute started to work on the problem of growing artificial crystals of silicon using the crucibleless method about 25 years ago," states Doctor of

Technical Sciences A.M. Shamov, deputy director of the Institute for Scientific Work. "This method makes it possible to obtain the "purest" single crystals without distortion of the crystal lattice, that is to say, the kind which are needed for making powerful solid-state devices."

A crystal 10 millimeters in diameter was obtained on the first setup at the Institute. Since then, the industrial demand for larger single crystals has increased immeasurably, especially for building powerful current converters. Obtaining each new large crystal means moving to a qualitatively new stage in solving a whole group of problems.

Upon developing one setup for growing artificial silicon, the collective immediately undertook the creation of a new, more sophisticated one even before the first one had been put into industrial use. Hundreds of different types of installations are now in operation at enterprises around the country which are being used to obtain practically all of the single-crystal silicon for the requirements of electrical power technology.

The crystal-growing process is a complicated matter which requires a thorough understanding of the essence of the processes occurring in the melting chamber, until work habits become automatic, as well as a special "sixth sense" of the material. Even the slightest change in the temperature, the speed with which the heater is moved or any other technological parameter can lead to distortions of the crystal lattice of the silicon being grown. There are therefore special requirements on the mastery of the operator who runs the experimental installation. The fact that the experiments generally proceed successfully is due in no small part to V.V. Nikandrov and V.S. Baldin, who have participated in testing several generations of equipment for growing single crystals. They were at the controls of the installation when the 125-millimeter single crystal of silicon was produced.

This stage of the work had been planned for the end of the year. However, the collective undertook increased socialist obligations to obtain the first experimental single crystal specimen by the 64th anniversary of the Great October Revolution -- and the specialists kept their word. Completing the assignment almost two months ahead of schedule, the collective made a substantial contribution to solving the problems facing the electricotechnical industry today.

The Department of Growing Equipment is rightfully considered one of the best in the institute, and is always among the leaders in socialist competition. A great deal of the credit for all of these successes belongs to department chief V.I. Dobrovol'skaya, who was among the first to begin working in this complicated area. A great deal of responsibility fell on the collective of the laboratory, which was directly involved in creating the setup for growing the new crystals, headed by experienced specialist D.G. Ratnikov. The mastery of the other creators of the setup -- V.I. Kir'yanov, G.A. Goryushin, N.Ye. Lipavskaya, V.S. Laskov -- must also be mentioned.

The development of predecessor installations for obtaining silicon crystals taught the specialists a number of valuable lessons. Rational organization of labor provided one of the greatest time savings. It was decided to create the actual installation and technology for growing a unique single crystal on it in parallel, rather than in stages. The designers and technologists worked in close contact, complementing and correcting one another on the basis of results achieved. Within a few months, the installation will be perfected. It remains to adjust many of the elements of the melting technology and to complete compilation of the technical documentation. Like all of the preceding problems, the collective is sure to solve these as soon as possible, in order to move on to industrial production of the device at the Theanrog Electrothermal Equipment Plant. According to preliminary calculations, the savings to be achieved from introducing just one installation for growing a 125-millimeter crystal will be more than 110,000 rubles annually.

The completion of definite anticipatory scientific work is one of the rules under which the workers at the Department of Growing Equipment have been working for many years. They are therefore already planning the next stage of the work -- mainly, planning a new installation which can be used to obtain single crystals of silicon, without dislocations, 150 millimeters in diameter. This will make possible a new step into the future in creating power bridges.

6900
CSO: 1860/187

UDC: 621.316.722

TRANSISTORIZED VOLTAGE REGULATOR FOR WIND-POWERED ELECTRIC UNITS

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian
No 1, Jan 82 (manuscript received 12 Jun 81) pp 97-99

MELESHKIN, V. N., candidate of technical sciences, docent, GORDEYEV, V. A.
and ZALOMOV, V. A., engineers, Order of Lenin and Order of Labor Red
Banner Institute of Railroad Transport Engineers, Moscow

[Abstract] A description is presented of a transistorized voltage regulator designed for use with the VIESKh D-4 wind-powered generator to replace the standard selenium rectifier and vibrating relay regulator. The new device converts the AC produced by the wind-powered generator to DC for charging of the unit's batteries, stabilizes the voltage and limits the generator current, and in addition also automatically excites the generator during acceleration and prevents battery discharge across the exciter circuit when the generator stops, and allows visual monitoring of the battery status. These additional functions help to improve the energy balance of the battery and increase the efficiency of the entire unit. A schematic diagram of the transistorized regulator is presented. The principle of operation is explained. Testing of experimental units under laboratory and field conditions has confirmed the efficiency of the regulator. Figures 1; references: 5 Russian.
[170-6508]

UDC: 535.2:621.382

RECORDING OF PULSE LASER RADIATION BY PHOTODETECTOR BASED ON MATRIX OF INSTRUMENTS WITH CHARGE COUPLING

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 21 Apr 80) pp 176-178

VOLKOV, V. F., PESHEL', A. K., SLOBODYAN, S. M. and TYRYSHKIN, I. S., Institute of Automated Control Systems and Electronics, Tomsk

[Abstract] A photodetector was used consisting of an image signal shaper made of a charge-coupled device with a surface transfer channel. A study was made of the possibility of using a charge-coupled matrix as a position-sensing receiver for measurement of laser radiation parameters with nanosecond pulse lengths. The charge-coupled device matrix proved to be simple and convenient in use for tuning and adjustment of the pulsed laser by monitoring the intensity in the beam. Figures 2; references 11: 8 Russian, 3 Western.
[172-6508]

UDC 537.876.23.029.7:551.510.5

FEASIBILITY OF COMPENSATING THERMAL DEFOCUSING OF LASER BEAMS BY MEANS OF PHASE CONJUGATE ADAPTIVE SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81 (manuscript received 24 Mar 80) pp 2334-2341

VOROB'YEV, V. V.

[Abstract] Defocusing of a laser beam by a large nonlinear medium such as a thick thermal lens is considered, and a feasibility study is made of compensation by means of a phase conjugate system. The analysis is based on the equation of beam propagation through a layer of a thickness much smaller than the diffraction length, without aberration, and with the nonlinear part of the dielectric permittivity a function of the space coordinates

and time as well as dependent on the luminous field intensity. The initial curvature of the phase front is determined from the condition that its curvature at the exit from the layer must be equal to the reciprocal of the distance from the latter to the target. The analysis is extended from a stationary to a moving nonlinear medium. Phase conjugate compensation involves an iterative solution of the front curvature equation. It is found to be effective only in the case of small nonlinearities and relatively thin lenses, as well as when the light beam intensity and the temperature field vary in time slowly. Such a compensation is not very effective at discrete instants of time, but becomes so with continuous correction of the phase front through an adaptive system which reads information about the derivatives of the front changing process. The author thanks V. I. Tatarskiy, A. P. Sukhorukov and M. A. Vorontsov for discussion and valuable comments. Figures 3; references 7: 6 Russian, 1 Western. [94-2415]

UDC 620.179.1:539.1.074:681.7

INFRARED IMAGER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 81 pp 49-52

MOROZOVA, S. P., MOROZOV, P.A ., CHAVUSER, G. Sh., KORNEVA, T. G., SHOLOKHOV, V. A., MALYSHEVA, T. P. and NEFED'YEV, V. A.

[Abstract] In recent years infrared imager methods of obtaining information have found increasingly wider use in scientific investigations, with non-destructive checking of products, medical diagnostics and others. Notwithstanding the marked widening of the spectrum of infrared imager equipment, as a rule the devices produced by industry are certified to a group of indicators. Development of measuring infrared imagers gives rise to pronounced difficulties, resulting in particular from the problem of forming a highly-stable base level of radiation, with respect to which precision measurements are conducted. In high-speed devices in which the speed of the rotating optical elements reaches tens of thousands of revolutions per minute, which excludes the possibility of mechanical synchronization of optical-mechanical units for line scanning and forming a base level of radiation, it is necessary to construct a complex system of automatic fine adjustment of the speed and phase of rotation of two optical-mechanical systems. The present work describes a device, during the development of which principal attention was directed to effective dynamic forming of a low-temperature highly-stable base level of radiation at every line of the image. The optical and electrical schemes are presented of infrared imagers intended for visualization and measurement of the temperature field at the surface of objects with a radiation capacity $\varepsilon \approx 1$ at the 30-200° range. Structurally the infrared imager consists of a receiving chamber, an electron indicator, a power supply unit and a unit for stabilization of the rotation of a motor. The basic parameters of the infrared imager are: temperature resolution during recording of radiation from a black body 0.3°, with

temperature of object 50° C; angle of visual field of receiving chamber of infrared imager 4°30' x 4°30'; dimensions of smallest objective with maximum dimension of its image on the screen of a 100 mm kinescope 100 mm; limits of focusing of receiving chamber from 1.5 m to infinity. A functional diagram of the PIR-1 spatial infrared imager is shown and explained. A mathematical analysis of the optical system of the device was made on a BESM-4 computer. The effect of the scanning elements on deformation of the circle of confusion in the plane of the radiation detector is presented. Figures 3; references: 1 Russian.
[139-6415]

UDC 621.373.1

HYDROGEN OSCILLATOR WITH SMALL RESONATOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 12 Mar 80) pp 2471-2472

BOCHKOV, V. A., GAYGEROV, B. A., KOROLEV, V. P. and RUSIN, F. S.

[Abstract] A hydrogen oscillator has the highest stability and the lowest frequency drift available. Its applications could be extended further, if its size and weight were reduced. One possible way to achieve this is to replace the conventional cylindrical H_{011}-mode resonator with a cylindrical H_{111}-mode resonator of less than half the size. A prototype of such a device was built with a copper resonator 21 cm high and 19.6 cm in diameter. Its original natural frequency near 2 GHz was lowered to the frequency of the hydrogen oscillator by means of metal plates spaced uniformly around a circle inside, symmetrical with respect to the axis. The number of plates and their dimensions as well as the diameter of their inscribing circle could be varied. With five 10-cm thick bars 11-cm long and 4.5-cm wide around a circle 11-cm in diameter (spherical oscillator bulb), oscillations were generated under a light resonator load. Reliable generation was maintained at a resonator Q-factor of $27\cdot10^3$, generation ceased when the resonator Q-factor had dropped to $23\cdot10^3$. Figures 1; references 4: 1 Russian, 3 Western.
[94-2415]

UDC 621.373.826:621.376

LIMITING DEPTH OF LIGHT MODULATION IN MICROWAVE ELECTROOPTICAL MODULATORS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 18 Apr 79) pp 2459-2461

GOLOVKOV, A. A. and GAGIYEV, N. G.

[Abstract] For microwave and lower-frequency light modulators one can use electrooptical crystals, in which standing waves of the modulation voltage are excited, with band filters having a uniform amplitude-frequency characteristic in the pass-band. Here an expression for the maximum permissible modulation depth in such modulators is derived, considering that at the modulation frequency such a crystal constitutes a segment of an open transmission line with a cosinusoidal voltage distribution over its length. The maximum modulation depth is limited by the requirement that the mean amplitude of the modulation voltage across the crystal not only be the maximum possible but also remain constant over the operating frequency band. The crystal can, for this purpose, be connected into a corrective RC circuit with a constant input resistance. The mean modulation voltage and the limiting modulation depth are calculated with the aid of the Richards frequency transformation and the Cauchy-Bunyakovskiy inequality. Calculations on this basis for a typical $LiNbO_3$ crystal and light of the 0.63 micrometer wavelength yield approximately 70% modulation with a constant-resistance circuit and only 20% modulation with a filter circuit over the 690-790 MHz range. Losses in the crystal have been disregarded. Figures 2; references 5: 4 Russian, 1 Western (in translation).
[94-2415]

UDC: 621.378.325

ACOUSTICOOPTICAL DELAY LINE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81
(manuscript received 15 Jul 80) pp 99-100

BUCHIN, A. V., MOROZOV, S. V., SERGEYENKO, T. N. and YAKOVLEV, V. I.,
Leningrad Electrical Engineering Communications Institute

[Abstract] Ultrasonic delay lines are frequently used to introduce delays of a few microseconds in signal processing operations. One shortcoming of these delay lines is their high level of reflections and the resulting false signals. Acousticooptical delay lines do not have this shortcoming. Such a delay line is diagrammed and described, and an oscillogram of the input and delayed signals presented. The signal to be delayed is fed to the input of an acousticooptical modulator, in which a traveling sonic wave is excited. As the ultrasonic waves pass through a section of the modulator which is illuminated by a narrow beam of light from a laser, the laser beam is

modulated in amplitude and phase in accordance with the delayed signal. The delayed signal is restored using optical heterodyning with a reference light beam formed by a diffraction grating that has a period equal to the length of the ultrasonic wave at the central frequency of the acoustico-optical modulator. Delay times of 0.5 to 20 μs can be achieved with the device. Figures 2; references: 3 Russian.
[172-6508]

UDC: 621.382.22.029.64.001.5

THIN-FILM METAL-OXIDE-METAL RADIATION RECEIVER LINE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov-Dec 81 (manuscript received 17 Jan 80) pp 190-192

KOSTENKO, M. I. and STROGANOV, V. I.

[Abstract] A study is presented of the possibility of using thin film metal-oxide-metal diodes with a receiving area of 50 x 50 μm^2 as IR and visible radiation receivers. Though less sensitive than point contact diodes, these devices have high stability, good durability and are simple to manufacture. The characteristics are reproducible. Figures 3; references 5: 3 Russian, 2 Western.
[172-6508]

UDC 681.7:658.562.01

INSTALLATION FOR CHECKING QUALITY OF OPTICAL ELEMENTS AT λ = 10.6 MICROMETER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 11, Nov 81 pp 52-53

LISYANSKIY, B. Ye., MOROZOV, P. A. and MOROZOVA, S. P.

[Abstract] The object of the present paper is to expand use of a method of evaluating the quality of optical elements by checking the "diffraction point" in the central and far regions of the infrared (IR) spectrum. The installation, the optical circuit of which is shown and explained, was created on the basis of a device for investigation of the quality of optical elements described in a 1978 work by B. Ye. Lisyanskiy (see above) and others. A scanning visualizer of IR images is used, operating in the regime of an IR microscope at λ = 10.6 micrometer with a magnification of 74x--120x. Figures 2; references: 2 Russian.
[139-6415]

UDC 771.537.61

MEASUREMENT OF FREQUENCY-CONTRAST CHARACTERISTICS OF HIGH RESOLUTION PHOTOGRAPHIC MATERIALS

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KENIMATOGRAFII
in Russian Vol 26, No 6, Nov-Dec 81 (manuscript received 14 Dec 79)
pp 409-412

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[Abstract] The choice and analysis of high resolution photographic materials, applicable for microelectronic, mocrofilmation and others requires knowledge of their actual frequency-contrast characteristics (FCC) in the range of spatial frequencies up to several thousands of mm^{-1}. Use of high-resolution materials for holography is limited to a large degree by knowledge of the frequency dependence of the diffraction effectiveness (DE), but in some cases in order to calculate the system it is necessary also to know the actual FCC of the material. The present work considers various methods for evaluation of the actual FCC. A simple method developed by the authors for evaluating photographic materials is presented. The evaluation is based on modified measurements of diffraction effectiveness which makes it possible to minimize the effect of the nonlinearity of the gradation characteristics and the phase structure of the image. Measurement of the FCC of one of three types of holographic materials is conducted. The results obtained by the method proposed in the work agree well with the results of other methods of measuring the actual FCC, and their difference from data obtained by the method ordinarily used of calculating the FCC with respect to diffraction effectiveness. Figures 3; references 13: 7 Russian, 6 Western.
[140-6415]

UDC 778.38:778.6

INCREASE OF DIFFRACTION EFFECTIVENESS DURING RECORDING OF COLORED REFLECTION HOLOGRAMS

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 26, No 6, Nov-Dec 81 (manuscript received 3 Feb 80) pp 413-416

S"YNOV, V. Kh., SPASOV, G. A. and S"YNOV, S. Kh., Central Laboratory of Optical Recording and Processing of Information, Bulgarian Academy of Sciences, Sofia, Bulgaria

[Abstract] Creation of colored reflection holograms with high diffraction effectiveness (DE) is essential for development of artistic and portrait holograms and in other areas. Recording is accomplished at three wavelengths

in the blue, green and red zones of the spectrum. The present work considers one of the possibilities of increasing the DE of colored reflection holograms with separation of recording in the blue-green and red zones of the spectrum. For this purpose a recording medium is used in the form of a double structure of two emulsion layers, one of which is sensitive to blue-green and the other to the red rays. A figure shows the recording scheme. Figures 4; tables 1; references 6: 5 Russian, 1 Western.
[140-6415]

UDC 534.212

ONE METHOD OF SUPPRESSING TRIPLE-ENTRY SIGNALS IN SURFACE ACOUSTIC WAVE FILTERS

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 51, No 12, Dec 81 (manuscript received 2 Feb 81) pp 2595-2597

PASKHIN, V. M., SANDLER, M. S. and SVESHNIKOV, B. V.

[Abstract] Triple-entry signals are caused by the reflection of surface acoustic waves from input and output interdigital transducers and these signals must be suppressed as much as possible in surface acoustic wave filters and delay lines. It is demonstrated here that with any thickness, h, of the electrodes of an opposing-pin transducer triple-entry signals can be suppressed to a sufficiently great degree by proper selection of the complex electrical loads of the transducers and the magnitude of these loads depends on h. A theoretical study is presented of the simplest filter consisting of two identidal non-apodized equidistant transducers with a specific spacing and with electrodes of specific width and thickness, whereby the opposing-pin transducers are loaded by identical external circuits with specific complex conductance. An equation is presented for the losses introduced by the filter, taking the conductance of the interdigital transducer into account, and for the suppression of triple-entry signals. The wave reflected from the transducer is considered to be the result of the interference of two waves, one caused by reflection from the pins as from individual independent inhomogeneities, and the other by electrical regeneration of the surface acoustic wave by the entire interdigital structure. It is demonstrated that the complex conductance of the external circuits, Y_0, can be so selected that the entire reflection coefficient and at the same time the level of the triple-entry signal will become sufficiently low even if reflections of the local (the first) type are quite substantial. The experimental conclusions were verified by a study of a surface acoustic wave filter with aluminum interdigital transducers on an ST-cut quartz substrate. An illustration is given of the possibility of substantially increasing the suppression of triple-entry signals by proper selection of interdigital transducer loads. Figures 2; references 5: 2 Russian, 3 Western.
[191-8831]

UDC 535.42:534.2

DIFFRACTION OF LIGHT BY ACOUSTIC SURFACE WAVE IN LITHIUM NIOBATE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 25, No 1, Jan 82
(manuscript received 23 Dec 80, after completion 4 May 81) pp 14-19

VOLOSHINOV, V. B., ZAKHAROV, V. G., PARYGIN, V. N., SOLODOV, I. Yu. and TANKOVSKI, N. S.

[Abstract] The results are given for a study of the interaction of light an sound in the repeated passing of an optical beam through a surface acoustic wave accompanied by interference phenomena and an increase in the effectiveness of the diffraction of light. A theoretical and experimental study are made of the diffraction of light by an ultrasound surface wave. The optical beam passes through the surface of a wafer of lithium niobate cut perpendicular to the y-axis and the surface acoustic wave is propagated along the z-axis. For this cut of a crystal, acousto-optical interaction and the conversion of electric power into acoustic are distinguished by a high degree of efficiency. The diffraction of light by a surface acoustic wave is calculated by means of a procedure suggested in an earlier work from the literature (1974) in which the medium for the interaction of light and sound is divided into thin layers. An expression is obtained for the intensity of the diffraction of light by a surface acoustic wave which is valid for any angle of incidence of the light and any degree of diffraction efficiency. Scattering in the diffraction grating formed by deformation of the surface of the crystal by the acoustic wave is taken into account. The equations derived were verified experimentally by using a crystal of lithium niobate. Surface acoustic waves were created in the 1.7 MHz frequency band by means of an interdigital transducer with a natural frequency of 37.6 MHz. The electrical parameters of the transducer were matched with the electric power generator by means of 0.5-μH induction coil connected in parallel with the transducer. Ultrasound was created in the form of trains 1 μs in duration and the optical beam was 0.2 to 0.3 cm in diameter with a wavelength of 633 nm. The light was polarized along the x- or z-axis of the crystal. The diffracted light in the first orders of diffraction was recorded by means of a photomultiplier tube. A measurement was made of the dependence of the efficiency of diffraction on the angle of incidence of the light when the light passes through the wafer and when it is reflected from a corrugated surface. The experiment demonstrated that with the repeated passing of light through ultrasound the efficiency of diffraction increases. With angles of incidence different from zero, the intensity of diffracted light is influenced by the phenomenon of interference between rays diffracted after each alternate passage of the primary beam through the ultrasonic diffraction grating. The experimental results and the results of calculating the intensity of diffraction with the repeated passing of light through ultrasound are in good agreement. Figures 4; tables 1; references 4: 2 Russian, 2 Western.
[190-8831]

UDC 621.373.12:621.37/39:534

THEORY OF SYNCHRONIZED SELF-EXCITABLE OSCILLATOR BASED ON SURFACE ACOUSTIC WAVES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 11, Nov 81
(manuscript received 8 Aug 80) pp 2321-2327

DVORNIKOV, A. A., OGURTSOV, V. I. and UTKIN, G. M.

[Abstract] External synchronization in the fundamental mode of a self-excitable single-frequency oscillator based on surface acoustic waves is analyzed by the "slowly varying amplitudes" method, assuming that the oscillator has a small self-excitation margin and is connected to a delay line. The signal from a synchronizing source is sent through a linear nonresonant transmission line to the control electrode of the active oscillator element. The width of the synchronization band is calculated from the equations for the rates of change of amplitude and phase. Calculations for an oscillator with an unmatched delay line reveal that it generally is an asynchronous oscillator, even with a noninductive active element, the width of its synchronization band being inversely proportional to the time delay and proportional to the amplitude of the synchronizing current. Amplitude-frequency and phase-frequency characteristics are shown based on a cubic ("soft") approximation of the current-voltage characteristic of the active element. Figures 3; references 7: 4 Russian, 3 Western.
[94-2415]

ASYNCHRONOUS INTERACTION OF BODY AND SURFACE ACOUSTIC WAVES

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 51, No 12, Dec 81
(manuscript received 9 Jan 81) pp 2593-2595

BOZHENKO, V. V., NAYDOV-ZHELEZOV, O. K. and SOLODOV, I. Yu., Moscow State University imeni M. V. Lomonosov

[Abstract] The results are given of an experimental study for the first time of the asynchronous interaction of surface and body acoustic waves obliquely striking the boundary of a piezoelectric-semiconductor layered structure. The possibility of this interaction is illustrated in a diagram of 3-wave interaction corresponding to the conditions for synchronism for the tangential components of the wave vectors of the interacting waves. It is shown that asynchronous interaction of surface and body acoustic waves can be observed both with the counter and parallel propagation of waves. Effects of the asynchronous interaction of surface and body acoustic waves were observed experimentally with concentration nonlinearity of layered structures of $LiNbO_3$-CdS and $LiNbO_3$-Si, whereby longitudinal acoustic waves were excited and received in a YZ-$LiNbO_3$ substrate by means of resonance transducers at a frequency of 30 MHz. The face of the substrate was inclined at an angle of 10 degrees to the Y axis of the $LiNbO_3$ to enable oblique incidence of the longitudinal wave onto the boundary. The frequency of the

body acoustic wave was approximately twofold higher than that of the surface acoustic wave. An opposing-pin transducer with a center frequency of 15 MHz was used to excite a surface acoustic wave in the Z direction of the substrate. Optically polished samples of CdS and Si semiconductors were placed on the surface of the substrate in the area of the trail of the longitudinal body acoustic wave. Processes of acoustically asynchronous interaction were observed by selecting the synchroization of pulses of the electric pumping field, the longitudinal waves and surface acoustic wave consistent with their encounter under the semiconductor. The results show that the effectiveness of nonlinear interaction depends on the conduction of the semiconductor, which was varied by illumination of the semiconductor in CdS-$LiNbO_3$ structures. Relaxation dependences of the amplitude of the resulting wave on the conduction of the chip were obtained experimentally and it was found that the maximum interaction of signals of equal frequencies is observed in the conduction region of 10^{-4} to 10^{-3} $(\Omega \cdot cm)^{-1}$. Measured values of the internal loss factor are given for processes of the interaction of body and surface acoustic waves in an Si-$LiNbO_3$ structure. It is believed that the asynchronous interaction of surface and body acoustic waves will have interesting practical applications. The authors are deeply grateful to V. Ye. Lyamov [deceased] for support of the work and consideration of its results. Figures 1; tables 1; references: 4 Russian. [191-8831]

INTERREPUBLIC STUDENT SCIENTIFIC SEMINAR 'RADIO INTERFERENCE AND ABATEMENT OF IT'

Moscow RADIOTEKHNIKA in Russian Vol 36, No 10, Oct 81 p 91

SHUL'GIN, A. V.

[Abstract] In Moscow, at the end of November 1980, the Fourth Interrepublic Student Scientific Seminar "Radio Interference and Abatement of It" was conducted at the VDNKh (Exhibition of the Achievements of the National Economy of the USSR) by the Central Administration of the Scientific and Technical Society of Radio Engineering, Electronics and Communications imeni A. S. Popov, and the Moscow Institute of Radio Engineering, Electronics and Automatics, together with VDNKh. In the work of the seminary, 162 persons (including 110 students) from 18 municipalities took part, who represented 25 higher institutes of learning and 22 scientific-technical organizations and enterprises. At the Plenary Session, Professor N. I. Chistyakov delivered the retrospective report "Contemporary Methods of Radio Interference Abatement." The report of Professor A. A. Pirogov "Radio Interference and the Problem of Effective Use of the Radio Spectra" was devoted to new methods of radiocommunication organization which assure a substantial decrease of the mutual interference from operating radio means. At the meetings of the seminar sections, 54 reports by students were heard and discussed. The subject fields of the reports are listed, and the names of a number of the students, as well as their specific subject and affiliate are given. Means of using the potential of the students were discussed. The 5th Seminar is planned for November-December 1982.
[90-A-6415]

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